SOIL SURVEY

Spokane County Washington

OUR SOIL ★ OUR STRENGTH

Issued March 1968

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
WASHINGTON AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1955 through 1961. Soil names and descriptions were approved in October 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1961. This survey was made cooperatively by the Soil Conservation Service and the Washington Agricultural Experiment Station; it is part of the technical assistance furnished to the North Spokane, Central Spokane, Southwest Spokane, Latah-Rock Creek, and Davenport-Reardan Soil and Water Conservation Districts.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Spokane County contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

Locating Soils

All the soils of Spokane County are shown on the detailed map at the back of this survey. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described and also the page for the capability unit, woodland group, range site, or any other group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability groups of soils and other interpretative groupings.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Ranchers and others who manage range can refer to the section "Range," where soils used mainly for grazing have been placed in range sites.

Engineers and builders will find under "Engineering Uses of Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text.

Newcomers in Spokane County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

U.S. GOVERNMENT PRINTING OFFICE: 1967

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

Contents

NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued March 1968

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
Series 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF SPOKANE COUNTY, WASHINGTON

BY NORMAN C. DONALDSON, and LAURENCE D. GIESE, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE[1]

SOILS SURVEYED BY NORMAN C. DONALDSON, IN CHARGE, LAURENCE D. GIESE, CHARLES W. NICHOLS, JACK L. WOOD, CLYDE C. BOWLSBY, and FRANK B. TAYLOR, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE WASHINGTON AGRICULTURAL EXPERIMENT STATION

SPOKANE COUNTY is in the eastern part of Washington bordering Idaho (fig. 1). It has a land area of 1,128,320 acres, or about 1,763 square miles.

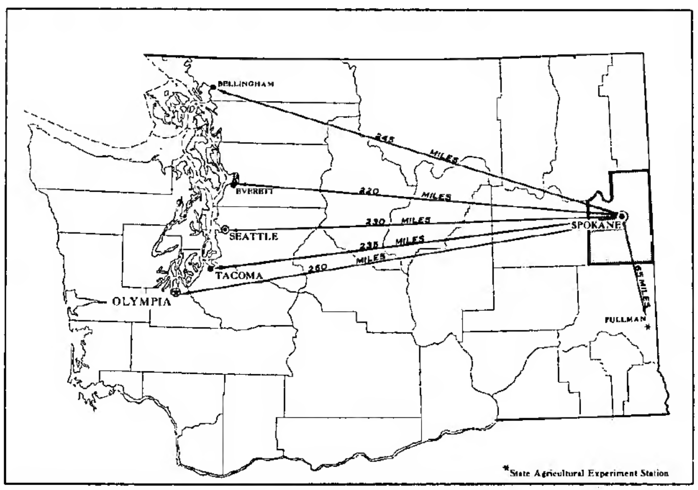


Figure 1.—**Location of Spokane County in Washington.**

The channeled scablands in the southwestern part of the county consists of a broad basalt plateau that was stripped of soil by glacial floodwaters. Only small, islandlike remnants of preglacial soils, such as the Lance Hills, were left after the glacial floods. Many channels were cut in the basalt bedrock. The channels run in a southwesterly direction. Some are now occupied by potholes and lakes. Badger, Williams, Downs, Clear, and Silver Lakes and the Medical Lakes are in this area.

The southeastern part of the county is in the Palouse Hills region, which is characterized by rolling to hilly topography and deep soils that formed in silty material deposited by wind. Basalt is the base rock, but there are a few promontories of quartzite, shale, and sandstone in the region. Tekoa Mountain, the highest part of this region, rises to an elevation of 3,900 feet.

[1] ROBERT F. MITCHELL assisted in reviewing the manuscript and in making final revisions.

The northern part of the county is in the Okanogan Highlands. This region consists of mountains, foot slopes, glaciated valleys, broad glacial lake terraces, and outwash terraces. It includes Mount Spokane, the highest point in the county, which has an elevation of 5,878 feet. Glacial scouring and damming by deposits left by glacial melt water created Newman, Liberty, and Eloika Lakes.

The county is drained by two principal streams—the Palouse River and the Spokane River. All the drainage water ultimately flows into the Columbia River. Approximately 400 square miles in the southwestern part of the county lie within the Palouse River basin. All the streams in this part of the county are intermittent except North Pine Creek. This area has many lakes and poorly drained depressions.

The Spokane River has only two perennial tributaries—the Little Spokane River from the north and Latah Creek from the south. The Little Spokane River drains the entire northern part of the county through Dragoon, Deep, Dry, Deer, and Deadman Creeks. Latah Creek drains all of the southeastern part of the county, but it discharges very little water into the Spokane River except spring runoff from melting snow.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Spokane County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down to the rock material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform

procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Cheney and Latah, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soil by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Bonner silt loam and Bonner loam are two soil types in the Bonner series. The difference in the texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, class of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their managemen could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Athena silt loam, 0 to 5 percent slopes, is one phase of Athena silt loam, a soil type that has a slope range of 0 to 70 percent.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew boundaries of individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and similar detail that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of other kinds that have been seen within an area that is dominantly of a recognized soil type or phase.

Five kinds of mapping units are used in this survey. In addition to the soil type and phase, which have been defined, there are the soil complex, the undifferentiated unit, and the miscellaneous land type.

A soil complex consists of soils of one or more series, so intricately mixed and in such small individual tracts that it is not practical to show them separately on the map. These soils occur in about the same pattern and proportion in all the delineated areas. A complex is named for the dominant soils, and the soil names are connected with a hyphen; for example, Cheney-Uhlig complex, 0 to 8 percent slopes. In some complexes, soils of only one series are dominant, for example, Cheney extremely rocky complex, 0 to 30 percent slopes.

An undifferentiated mapping unit consists of two or more soils that, unlike the soils in a complex, occur together without regularity in pattern and proportion. At least one of the soils occurs in every delineated area. All of the soils may occur in some areas, and more than one, but not all, in others. The individual areas of the soils may be large enough to be mapped separately. Generally, however, the soils of an undifferentiated unit are so similar in their use and management that their separation is not important for the purpose of the soil survey. An undifferentiated unit that consists of soils of two or more series is named for the dominant series, and the soil names are connected with the word "and"; for example, Bong and Phoebe fine sandy loams, 0 to 8 percent slopes. Some undifferentiated units, however, are made up of soils of only one series, for example, Bernhill soils, 20 to 55 percent slopes.

Miscellaneous land types consist of unweathered soil material, or are so shallow or so severely eroded that they cannot be called soils. These areas are given descriptive names, such as Rock outcrop or Riverwash.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others; then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Spokane County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The nine soil associations in Spokane County are described on the following pages.

1. Naff-Larkin-Freeman association

Medium-textured to fine-textured soils on rolling loessal uplands, glacial till plains, and mountain foot slopes

This association is in the southeastern part of the county. It is characterized by rolling hills. The slope range is from nearly level to steep. The native vegetation was either grass or open stands of ponderosa pine and an understory of grass. The elevation ranges from 2,500 to 4,000 feet. The annual precipitation is 18 to 23 inches.

This association makes up about 15 percent of the county area. About 58 percent of the association is Naff soils, 10 percent Freeman soils, 9 percent Larkin soils, 8 percent Caldwell soils, and 8 percent Dearyton soils. Schumacher, Nez Perce, Tekoa, Garfield, Palouse, Snow, and Latah soils occur in fairly large bodies but are of minor extent.

Naff, Larkin, Freeman, Palouse, Nez Perce, and Garfield soils are on rolling loessal uplands. Schumacher and Tekoa soils occupy quartzite, shale, and sandstone promontories. Dearyton soils are on nearly level to moderately sloping, glaciated mountain foot slopes. Caldwell, Latah, and Snow soils are along drainageways, on lower terraces, and on foot slopes.

Naff soils are deep, very dark brown, well drained, and silty. Larkin soils are also deep, well drained, and silty, but they have a thin, very dark grayish-brown surface layer. Freeman and Dearyton soils are deep and moderately well drained and have a very dark grayish brown surface layer of silt loam underlain by a subsoil of silty clay loam or silty clay. Caldwell soils are deep, medium textured throughout, and somewhat poorly drained.

Fall and winter precipitation provides as much moisture as the soils can hold, and rains late in spring replenish the supply. Crops can be grown each year and are usually grown in rotation. Grain, peas, and lentils are the main cash crops. Grass is grown for seed, and grass and alfalfa or clover are grown for hay and green manure. Farms range in size from 160 to more than 640 acres.

2. Garrison-Marble-Springdale association

Somewhat excessively drained and excessively drained sandy and gravelly soils formed in glacial outwash

This association occurs on both sides of the Spokane River and extends from the Idaho line on the east to Lincoln County on the west. The topography is nearly level to gently sloping, except for steep terrace breaks along drainageways. The native vegetation was bunchgrass or open stands of ponderosa pine and an understory of bunchgrass. Large areas are still under natural vegetation, but a large part, including Spokane and Spokane Valley, is urban. The elevation ranges from 1,900 to 2,400 feet. The annual precipitation is 17 to 21 inches.

This association makes up about 11 percent of the county. About 35 percent of it is Garrison soils, 30 percent Marble soils, 15 percent Springdale soils, and 5 percent each Bong, Clayton, and Phoebe soils. The remaining 5 percent consists of a few fairly large areas of Semiahmoo and Hardesty soils and small areas of Wethey soils.

Garrison and Bong soils are on nearly level to moderately steep outwash terraces. Marble soils are on dunelike terraces. Springdale soils occur on broad, nearly level terraces, on steep terrace breaks, and in areas that slope down to drainageways. Clayton soils are on nearly level terraces. On high terraces and alluvial fans are the Phoebe soils. The Semiahmoo, Hardesty, and Wethey are minor soils. They occur in depressions on terraces, at the foot of terrace breaks, in seepage spots, and along streams.

Garrison soils are nearly black, are gravelly and medium textured, and are somewhat excessively drained. Marble soils are light colored, coarse textured, excessively drained, and very deep. Springdale soils are light colored, gravelly, and moderately coarse textured. They are somewhat excessively drained and deep or moderately deep. A few areas of Springdale soils are cobbly. Bong and Phoebe soils are nearly black, are moderately coarse textured, and are somewhat excessively drained. Clayton soils are light colored, moderately coarse textured, and somewhat excessively drained. The poorly drained Semiahmoo soils are in basins or depressions and consist of muck underlain by peat or pumice. Hardesty soils are light colored and medium textured and occur in depressions at the lower edge of terrace breaks.

Garrison, Bong, Phoebe, and Hardesty soils are suited to small grain, alfalfa, and grass. Much of the acreage of Garrison soils is irrigated, and a variety of grain, orchard, and vegetable crops are grown. Springdale, Clayton, and Marble soils are better suited to pasture and to trees than to crops; however, alfalfa also grows fairly well on these soils once it is established. Semiahmoo soils are used for oats, grass, and clover. Most farms in this association are less than 200 acres in size.

3. Spokane-Dragoon association

Shallow to deep, medium-textured soils that formed in material weathered from acid igneous rock on mountain foot slopes

This association occurs in the eastern part of the county, in the northwestern part along the Spokane River, and in the west-central part between the towns of Cheney and Four Lakes. The topography ranges from nearly level to hilly and very steep. The native vegetation consisted of grass, ponderosa pine, and Douglas-fir. The elevation ranges from 2,100 to 3,000 feet. The annual precipitation is 16 to 18 inches.

This association makes up about 7 percent of the total acreage of the county. About 90 percent of it consists of Spokane soils, and about 5 percent of Dragoon soils. Small areas of Narcisse and Hardesty soils occupy narrow drainageways, alluvial fans, depressions, and the base of rock ledges.

Spokane and Dragoon soils formed in material weathered from granite, gneiss, or schist. Both are well drained. Spokane soils are moderately coarse textured, have a thin, dark-colored surface layer, and grade, at a depth of 1 to 5 feet, into disintegrating rock. Dragoon soils are dark colored and medium textured. They grade into disintegrating rock at a depth of 20 to 40 inches. Narcisse soils are deep, dark colored, medium textured, and somewhat poorly drained. Hardesty soils are deep, have a light-colored surface layer, and are moderately well drained. They formed in volcanic ash.

Neither Spokane nor Dragoon soils are well suited to cultivated crops, but they are well suited to ponderosa pine and Douglas-fir and to pasture. The lower slopes and the areas where these soils are deepest have been cleared and are used for alfalfa, grass, and small grain. Narcisse soils also are used for small grain, alfalfa, and grass. Most farms in this association are about 200 acres in size.

4. Bernhill association

Deep, well drained and moderately well drained soils that formed chiefly in glacial lake sediments and glacial till on uplands

Part of this association is north of Spokane on Green Bluff and Orchard Bluff and on Peone, Orchard, Fivemile, Wild Rose, and Pleasant Prairies; part of it is south of Spokane on Moran Prairie; and part is on the glaciated foot slopes. The topography is nearly level to very steep. The native vegetation consisted of bunchgrass and mixed conifers. The elevation ranges from 1,800 to 2,500 feet. The annual precipitation is 18 to 22 inches.

This association makes up about 11 percent of the county. About 60 percent of the association is Bernhill soils, 12 percent Uhlig soils, 8 percent Glenrose soils, and 7 percent Green Bluff soils. Snow, Cedonia, Lakesol, and Hardesty soils occur as fairly large areas but are much less extensive than the others. Peone and Konner soils occur as small areas along narrow drainageways and intermittent streams. Small areas of Nez Perce soils, mostly on Pleasant Prairie, are also present.

Bernhill and Green Bluff soils occupy nearly level to steep basaltic plateaus and glaciated mountain foot slopes. Uhlig and Glenrose soils are nearly level to steep and are on Peone, Fivemile, Pleasant, Orchard, and Moran Prairies. Snow soils are nearly level to moderately sloping and are on Peone and Moran Prairies. Cedonia soils occupy nearly level to moderately sloping terraces at the eastern edge of Peone Prairie. Lakesol soils are nearly level to strongly sloping and occur on dissected terraces in the vicinity of Wild Rose Prairie. Hardesty soils are in slight depressions and nearly level areas along drainageways.

Bernhill, Uhlig, Glenrose, and Green Bluff soils are deep, medium-textured soils that formed in glacial till and loess. The well-drained Uhlig and Glenrose soils are black, and the well-drained Bernhill and the moderately well drained Green Bluff soils are very dark grayish brown. Snow soils formed in loess and volcanic ash and are deep, black, medium textured, and well drained. Hardesty soils also formed in volcanic ash; they are deep but have a light-colored surface layer and are moderately well drained. Lakesol and Cedonia soils are deep, light colored, and medium textured. Cedonia soils formed in loess and calcareous lake sediments, and Lakesol soils formed in loess and noncalcareous lake sediments.

Fall and winter precipitation provides as much moisture as the soils can hold, and rains late in spring replenish the supply. Fertility is moderate to high. Many kinds of crops are grown, generally in rotation. Grain, peas, lentils, grass for seed, and alfalfa and grass for hay are the chief cash crops. Some areas, mainly the steeper ones, remain in timber. Orchard fruits, berries, and vegetables are also grown. Most farms are about 200 acres in size.

5. Hesseltine-Cheney-Uhlig association

Dominantly moderately deep to shallow, gravelly or rocky soils of the channeled scablands

This association is on broad basaltic outwash plains south of the Spokane River, mostly in the western and southwestern parts of the county. It has undulating relief and is dissected by many channels that run in a southwesterly direction. In these channels are lakes, potholes, and poorly drained depressions. The original vegetation consisted of bunchgrass and scattered ponderosa pines. The elevation ranges from 2,300 to 2,500 feet. The annual precipitation is 16 to 20 inches.

This association makes up about 32 percent of the county. About 53 percent of the association is Hesseltine soils, 16 percent Cheney soils, and 12 percent Uhlig soils. These soils are on the outwash plains. The rest consists of Bong and Phoebe soils, of small areas of Speigle soils on steep colluvial slopes, and of Cocolalla, Emdent, Caldwell, and Semiahmoo soils along drainageways and intermittent streams and in potholes and depressions.

Cheney, Hesseltine, and Uhlig soils are well drained and medium textured and are underlain by gravel, cobblestones, or basalt. Bong and Phoebe soils are well drained or somewhat excessively drained, dark colored, and moderately coarse textured and are underlain by coarse sand at a depth of 30 to 48 inches. Caldwell, Cocolalla, and Emdent soils are somewhat poorly drained or poorly drained, dark colored, and medium textured. Speigle soils, which are near basalt escarpments, are very stony and steep. Semiahmoo soils are poorly drained or very poorly drained, dark-colored muck soils.

In winter and spring all of these soils are saturated, and the potholes, depressions, and drainageways are ponded. The shallow upland soils dry out rapidly, however.

Small grain, alfalfa, clover, and grass are the major crops. The shallow soils and the steep soils are used for pasture or timber. Most farms are more than 700 acres in size.

6. Moscow-Vassar association

Moderately deep and deep, medium-textured soils of the hilly and mountainous areas

This association is in the northeastern part of the county where the topography is hilly and mountainous; slopes range from gentle to very steep. The vegetation consists of mixed conifers. The elevation ranges from 3,000 to 5,800 feet. The annual precipitation is 25 to 45 inches.

This association occupies about 8 percent of the county. Moscow soils make up 80 percent of the association, and Vassar soils 18 percent. In general, Vassar soils are at elevations above 4,000 feet, and Moscow soils are at lower elevations. Brickel soils occupy high, stony grasslands, and Narcisse soils are dominant in drainageways.

Moscow and Vassar soils are light colored, medium textured, and well drained. The upper part of the Vassar soils formed in a layer of volcanic ash; the lower part formed in material weathered in place from granite, gneiss, or schist. Moscow soils formed mainly in residuum weathered from granite, gneiss, or schist; the upper part of this material also included volcanic ash. Brickel soils are dark colored, well drained, stony, and medium tex-

tured. Narcisse soils are nearly black, deep, medium textured, and moderately well drained.

The soils in this association are not well suited to cultivated crops, mainly because they are erodible and the growing season is short. Moscow and Vassar soils are well suited to Douglas-fir, grand fir, western white pine, and western larch. Hemlock, lodgepole pine, and cedar also grow well. Ponderosa pine grows well on Moscow soils that are on south-facing slopes. Brickel soils support grass, sedge, and scattered alpine fir trees. They are suited to use as wildlife habitats, recreational areas, and watersheds. Narcisse soils are used for small grain, alfalfa, and grass. Much of this association is in Mount Spokane State Park. Most farms exceed 1,000 acres in size.

7. *Athena-Reardan association*

Medium-textured and moderately fine textured soils formed chiefly in loess

This association consists of a number of areas in the western and southwestern parts of the county. It is characterized by rolling hills, but the slope range is from nearly level to steep. The original vegetation was mainly bunchgrass. The elevation ranges from 2,400 to 2,800 feet, and the annual precipitation is 15 to 18 inches.

This association makes up about 4 percent of the county. The Athena and Reardan soils occupy the rolling hills. Athena soils make up 71 percent of the association, and Reardan soils 11 percent. Lance soils occur as small but prominent areas, mostly intermingled with Athena soils. Small, nearly level areas of Mondovi soils occur along narrow drainageways and alluvial fans.

All the soils in this association are well drained. Athena and Reardan soils are deep and dark colored. Athena soils are medium textured throughout, but Reardan soils have a medium-textured surface layer and a moderately fine textured or fine textured subsoil. Generally they are at lower elevations than Athena soils. Lance soils occupy the narrow ridgetops and upper side slopes. They are medium textured, have a light-colored surface layer, and are calcareous. Mondovi soils are very deep, are medium textured, and have a thick, nearly black surface layer.

Most of this association is used for grain. Peas, alfalfa, sweetclover, and grass are grown in rotation with grain in some places. Fertility is high. Most farms are more than 500 acres in size.

8. *Clayton-Laketon association*

Very deep, medium-textured and moderately coarse textured soils on terraces

This association occurs in the northwestern part of the county on nearly level to gently sloping outwash terraces and reworked lake terraces. The original vegetation consisted of conifers and an understory of grass and shrubs. The elevation ranges from 2,000 to 2,200 feet. The annual precipitation is about 22 inches.

This association makes up about 4 percent of the county. About 85 percent of the association is Clayton soils, and about 5 percent is Laketon soils. Both occupy the smooth terraces. Small areas of Bridgeson and Konner soils occur along narrow drainageways and intermittent streams. Small but prominent areas of Wolfeson soils are interspersed with Clayton and Laketon soils on the terraces.

Clayton, Laketon, and Wolfeson soils are very deep and light colored. Clayton and Laketon soils are well drained. The surface layer of the Clayton soils is fine sandy loam, and the subsoil has irregular, wavy, dark-brown, loamy bands. Laketon soils consist of silt loam underlain by stratified silty lake sediments. Wolfeson soils are somewhat poorly drained, moderately coarse textured soils that have a massive, compacted layer in the subsoil. Bridgeson and Konner soils are dark colored and somewhat poorly drained. Bridgeson soils have a silty clay loam subsoil, and Konner soils a clay loam subsoil.

Clayton and Laketon soils are well suited to Douglas-fir, lodgepole pine, ponderosa pine, and western larch, but, because these are among the best soils in the county, most areas are cleared and used for grain, alfalfa, and grass. Although the frost-free period is only about 100 days, yields are high. The Bridgeson, Konner, and Wolfeson soils are used mainly for clover and grass. About 80 percent of this association has been cleared of timber. Farms average about 160 acres in size.

9. *Bonner-Eloika-Hagen association*

Gravelly and sandy soils that formed in glacial materials

This association is on outwash plains north of Spokane near Chattaroy, Deer Park, and Eloika Lake. The topography in most places is nearly level, undulating, or gently sloping. The vegetation consists mainly of lodgepole pine, Douglas-fir, ponderosa pine, and western larch. The elevation ranges from 2,000 to 2,400 feet. The annual precipitation is about 23 inches.

This association makes up about 8 percent of the county. About 40 percent of it is Bonner soils, 35 percent Eloika soils, and 9 percent Hagen soils. These soils are on the outwash plains. Along narrow drainageways and on alluvial fans are small areas of Wethey and Narcisse soils. Small areas of Semiahmoo soils occur along Bear Creek and near Bailey Lake.

Bonner soils formed in glacial outwash mixed with loess and volcanic ash. They are light colored and somewhat excessively drained and are underlain at a depth of 20 to 30 inches by coarse sand and gravel. Eloika soils are also light colored, but they are well drained and are more than 30 inches deep to coarse sand and gravel. They formed in glacial till mixed in the upper part with volcanic ash. Hagen soils are coarse textured, are somewhat excessively drained, and are underlain by coarse sand below a depth of 30 inches. They formed in volcanic ash mixed with glaciofluvial deposits derived from granitic rock. Wethey soils are dark colored, medium textured, and somewhat poorly drained. Semiahmoo soils are poorly drained organic soils.

The soils in this association are used mainly for growing timber and for limited grazing. Cleared areas are used for small grain, alfalfa, and grass for pasture or seed. Most of the soils are too droughty for crops other than alfalfa and grass. Farms range from 40 to more than 1,000 acres in size.

Descriptions of Soils

In this section the soil series and mapping units are described in alphabetical order. Following the general description of each series, the most nearly typical soil of the series is described in detail, and others in the series are described briefly, mostly by comparison with the typical soil. Unless otherwise stated, the terms describing color and consistence are for moist soil. Soil reaction, as described in this section of the report, was determined by a field test using a dilution of about 1 to 5. The approximate acreage and proportionate extent of the soils are given in table 1.

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soils	Area	Extent
	Acres	*Percent*
Athena silt loam, 5 to 30 percent slopes	32,073	2.8
Athena silt loam, 0 to 5 percent slopes	864	.1
Athena silt loam, 30 to 55 percent slopes	1,520	.1
Athena silt loam, 55 to 70 percent slopes	170	[1]
Athena-Lance silt loams, 0 to 30 percent slopes	3,015	.3
Athena-Lance silt loams, 30 to 55 percent slopes	601	.1
Bernhill silt loam, 0 to 20 percent slopes	16,580	1.5
Bernhill silt loam, 20 to 30 percent slopes	8,767	.8
Bernhill silt loam, 30 to 55 percent slopes	3,959	.4
Bernhill silt loam, moderately shallow, 0 to 20 slopes	12,297	1.2
Bernhill silt loam, moderately shallow, 30 to 55 percent slopes	2,051	.2
Bernhill gravelly silt loam, 0 to 20 percent slopes	5,123	.5
Bernhill very stony silt loam, 0 to 20 percent slopes	3,034	.3
Bernhill very stony silt loam, 20 to 55 percent slopes	5,953	.5
Bernhill soils, 20 to 55 percent slopes	3,634	.3
Bernhill very rocky complex, 0 to 30 percent slopes	2,509	.2
Bernhill very rocky complex, 30 to 55 percent slopes	2,643	.2
Bong coarse sandy loam, 0 to 8 percent slopes	792	.1
Bong and Phoebe fine sandy loams, 0 to 8 percent slopes	10,294	.9
Bong and Phoebe coarse sandy loams, 0 to 20 percent slopes	589	.1
Bong and Phoebe coarse sandy loams, 20 to 30 percent slopes	240	[1]
Bong and Phoebe loamy sands, 0 to 20 percent slopes	1,150	.1
Bonner silt loam, 0 to 8 percent slopes	3,148	.3
Bonner gravelly silt loam, 0 to 20 percent slopes	520	.1
Bonner loam, 0 to 20 percent slopes	17,019	1.5
Bonner fine sandy loam, 0 to 20 percent slopes	1,116	.1
Brickel stony loam, 20 to 55 percent slopes	1,173	.1
Bridgeson silt loam	725	.1
Bridgeson silt loam, drained	553	.1
Caldwell silt loam	10,341	.9
Cedonia silt loam, 0 to 5 percent slopes	401	[1]
Cedonia silt loam, 5 to 20 percent slopes	1,259	.1
Cedonia silt loam, 20 to 30 percent slopes, severely eroded	1,008	.1
Cheney gravelly silt loam, 0 to 8 percent slopes	16,342	1.5
Cheney stony silt loam, 0 to 20 percent slopes	30,528	2.7
Cheney very rocky complex, 0 to 30 percent slopes	11,400	1.0
Cheney extremely rocky complex, 0 to 30 percent slopes	1,393	.1
Cheney and Uhlig silt loams, 0 to 8 percent slopes	30,280	2.7
Cheney-Uhlig complex, 0 to 8 percent slopes	25,605	2.3
Clayton fine sandy loam, 0 to 5 percent slopes	11,448	1.0
Clayton fine sandy loam, 5 to 20 percent slopes	4,198	.4
Clayton loam, 0 to 5 percent slopes	11,181	1.0
Clayton loam, 5 to 20 percent slopes	6,754	.9
Clayton sandy loam, 0 to 8 percent slopes	4,322	.4
Cocolalla silty clay loam	925	.1
Cocolalla silty clay loam, drained	12,917	1.1
Dearyton silt loam, 5 to 20 percent slopes	9,184	.8
Dearyton silt loam, 0 to 5 percent slopes	570	.1
Dearyton silt loam, 20 to 40 percent slopes	1,336	.1
Dearyton silt loam, thin solum variant, 0 to 20 percent slopes	401	[1]
Dragoon silt loam, 0 to 30 percent slopes	1,246	.1
Dragoon stony silt loam, 0 to 30 percent slopes	1,155	.1
Dragoon stony silt loam, 30 to 55 percent slopes	328	[1]
Dragoon very rocky complex, 20 to 55 percent slopes	450	( )
Eloika silt loam, 0 to 20 percent slopes	15,245	1.3
Eloika very stony silt loam, 0 to 30 percent slopes	3,911	.3
Eloika very stony silt loam, 30 to 55 percent slopes	340	[1]
Emdent silt loam	1,526	.1
Freeman silt loam, 5 to 20 percent slopes	17,296	1.5
Freeman silt loam, 5 to 20 percent slopes, severely eroded	78	[1]
Freeman silt loam, 20 to 30 percent slopes, severely eroded	619	.1
Fresh water marsh	16,274	1.4
Garfield silty clay loam, 0 to 30 percent slopes, severely eroded	1,169	.1
Garrison gravelly loam, 0 to 5 percent slopes	31,999	2.8
Garrison gravelly loam, 5 to 20 percent slopes	1,870	.2
Garrison very gravelly loam, 0 to 8 percent slopes	2,662	.2
Garrison very stony loam, 0 to 20 percent slopes	954	.1
Glenrose silt loam, 5 to 20 percent slopes	7,411	.7
Glenrose silt loam, 0 to 5 percent slopes	192	[1]
Glenrose silt loam, 20 to 30 percent slopes	749	.1
Glenrose silt loam, 30 to 55 percent slopes	199	[1]
Glenrose gravelly silt loam, 5 to 20 percent slopes	360	[1]
Glenrose gravelly silt loam, 20 to 55 percent slopes	181	[1]
Glenrose stony silt loam, 20 to 55 percent slopes	201	[1]
Green Bluff silt loam, 0 to 5 percent slopes	3,806	.3
Green Bluff silt loam, 5 to 20 percent slopes	3,959	.3
Hagen sandy loam, 0 to 20 percent slopes	3,730	.3
Hagen loamy fine sand, 0 to 30 percent slopes	5,352	.5
Hardesty silt loam, 0 to 5 percent slopes	4,360	.4
Hardesty silt loam, moderately shallow, 0 to 5 percent slopes	1,250	.1
Hesseltine silt loam, 0 to 10 percent slopes	9,654	.9
Hesseltine silt loam, moderately deep, 0 to 8 percent slopes	19,137	1.7
Hesseltine gravelly silt loam, 0 to 10 percent slopes	3,100	.3
Hesseltine stony silt loam, 0 to 20 percent slopes	48,196	4.3
Hesseltine stony silt loam, mounded, 0 to 8 percent slopes	20,196	1.8

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of soils*—Continued

Soils	Area	Extent
	Acres	*Percent*
Hesseltine very rocky complex, 0 to 30 percent slopes	79, 345	7. 0
Hesseltine very rocky complex, 30 to 55 percent slopes	1, 736	. 1
Hesseltine extremely rocky complex, 0 to 30 percent slopes	20, 816	1. 8
Konner silty clay loam	680	. 1
Konner silty clay loam, drained	1, 427	. 1
Lakesol silt loam, 0 to 20 percent slopes	1, 336	. 1
Lakesol silt loam, 20 to 55 percent slopes	251	[1]
Laketon silt loam, 0 to 5 percent slopes	2, 996	. 3
Laketon silt loam, 5 to 20 percent slopes	781	. 1
Laketon fine sandy loam, 0 to 5 percent slopes	1, 421	. 1
Lance silt loam, 0 to 30 percent slopes, severely eroded	4, 824	. 4
Lance silt loam, 0 to 30 percent slopes	239	[1]
Larkin silt loam, 5 to 20 percent slopes, eroded	16, 206	1. 4
Larkin silt loam, 0 to 5 percent slopes, eroded	687	. 1
Larkin silt loam, 20 to 45 percent slopes, eroded	610	. 1
Latah silt loam	658	. 1
Marble loamy sand, 0 to 30 percent slopes	9, 549	. 8
Marble sandy loam, 0 to 8 percent slopes	24, 508	2. 2
Marble loamy coarse sand, 0 to 30 percent slopes	11, 019	1. 0
Mondovi silt loam	3, 307	. 3
Moscow silt loam, 30 to 55 percent slopes	42, 682	3. 8
Moscow silt loam, 0 to 30 percent slopes	15, 765	1. 4
Moscow silt loam, shallow, 0 to 30 percent slopes	5, 218	. 5
Moscow silt loam, shallow, 30 to 55 percent slopes	3, 730	. 3
Moscow very rocky complex, 0 to 30 percent slopes	906	. 1
Moscow very rocky complex, 30 to 70 percent slopes	267	[1]
Naff silt loam, 5 to 30 percent slopes	4, 016	. 4
Naff silt loam, 0 to 5 percent slopes	687	. 1
Naff silt loam, 0 to 5 percent slopes, eroded	515	. 1
Naff silt loam, 5 to 30 percent slopes, eroded	98, 614	8. 7
Naff silt loam, 30 to 45 percent slopes, eroded	4, 797	. 4
Naff silt loam, 0 to 30 percent slopes, severely eroded	3, 186	. 3
Narcisse silt loam, 0 to 5 percent slopes	5, 152	. 5
Nez Perce silt loam, 0 to 5 percent slopes	820	. 1
Nez Perce silt loam, 5 to 20 percent slopes	718	. 1
Nez Perce silt loam, 5 to 20 percent slopes, severely eroded	3, 288	. 3
Palouse silt loam, moderately shallow, 0 to 20 percent slopes	925	. 1
Palouse silt loam, moderately shallow, 20 to 30 percent slopes	630	. 1
Palouse silt loam, 5 to 30 percent slopes, eroded	503	[1]
Palouse very rocky complex, 0 to 30 percent slopes	487	[1]
Palouse very rocky complex, 30 to 70 percent slopes	383	[1]
Peone silt loam, 0 to 5 percent slopes	1, 402	. 1
Peone silt loam, drained, 0 to 5 percent slopes	1, 087	. 1
Phoebe sandy loam, 0 to 5 percent slopes	6, 430	. 6
Phoebe sandy loam, 5 to 20 percent slopes	1, 904	. 2
Reardan silt loam, 5 to 20 percent slopes	4, 532	. 4
Reardan silt loam, 0 to 5 percent slopes	973	. 1
Reardan silt loam, 5 to 20 percent slopes, eroded	5, 364	. 5
Reardan silt loam, 20 to 30 percent slopes, eroded	629	. 1
Riverwash	2, 786	0. 2
Rock outcrop	2, 776	. 2
Schumacher silt loam, 0 to 20 percent slopes	400	[1]
Schumacher silt loam, 20 to 30 percent slopes	556	. 1
Schumacher silt loam, 30 to 55 percent slopes	385	[1]
Schumacher gravelly silt loam, 5 to 30 percent slopes	207	[1]
Schumacher gravelly silt loam, 30 to 55 percent slopes	236	[1]
Schumacher silt loam, 0 to 20 percent slopes, eroded	3, 000	. 3
Schumacher silt loam, 20 to 30 percent slopes, eroded	437	[1]
Schumacher gravelly silt loam, 5 to 30 percent slopes, eroded	395	[1]
Schumacher gravelly silt loam, 30 to 55 percent slopes, eroded	504	[1]
Semiahmoo muck, drained	3, 281	. 3
Semiahmoo muck	1, 154	. 1
Semiahmoo muck, moderately shallow, drained	506	[1]
Snow silt loam, 0 to 5 percent slopes	2, 060	. 2
Snow silt loam, 5 to 30 percent slopes	1, 486	. 1
Speigle very stony silt loam, 30 to 70 percent slopes	6, 096	. 5
Spokane loam, 0 to 30 percent slopes	14, 991	1. 3
Spokane loam, 30 to 55 percent slopes	9, 397	. 8
Spokane stony loam, 0 to 30 percent slopes	4, 913	. 4
Spokane stony loam, 30 to 70 percent slopes	2, 652	. 2
Spokane complex, 0 to 30 percent slopes	10, 990	1. 0
Spokane complex, 30 to 70 percent slopes	6, 363	. 6
Spokane very rocky complex, 0 to 30 percent slopes	10, 656	. 9
Spokane very rocky complex, 30 to 70 percent slopes	7, 947	. 7
Spokane extremely rocky complex, 20 to 70 percent slopes	4, 369	. 4
Springdale gravelly sandy loam, 0 to 20 percent slopes	6, 344	. 6
Springdale gravelly loamy sand, 30 to 70 percent slopes	4, 751	. 4
Springdale gravelly sandy loam, deep, 0 to 20 percent slopes	6, 897	. 6
Springdale cobbly sandy loam, 0 to 20 percent slopes	3, 825	. 3
Tekoa gravelly silt loam, 30 to 55 percent slopes	1, 515	. 2
Takoa gravelly silt loam, 5 to 20 percent slopes	677	. 1
Tekoa gravelly silt loam, 20 to 30 percent slopes	952	. 1
Tekoa very rocky complex, 25 to 55 percent slopes	778	. 1
Uhlig silt loam, 5 to 20 percent slopes	7, 680	. 7
Uhlig silt loam, 0 to 5 percent slopes	14, 854	1. 3
Uhlig silt loam, moderately shallow, 5 to 30 percent slopes	2, 596	. 2
Vassar silt loam, 30 to 55 percent slopes	9, 607	. 8
Vassar silt loam, 0 to 30 percent slopes	250	[1]
Vassar very rocky silt loam, 20 to 55 percent slopes	4, 551	. 4
Wethey loamy sand	1, 660	. 2
Wethey loamy sand, drained	620	. 1
Wolfeson very fine sandy loam	1, 154	. 1
Total	1, 128, 320	100. 0

[1] Less than 0.1 percent.

For more detailed information about how the soils can be used, see the section "Use and Management of Soils." Near the back of the report is a "Guide to Mapping Units," which lists the soils mapped in the county and shows the capability unit, range site, and woodland suitability group in which each has been placed. The location and distribution of the soils are shown on the detailed soil map at the back of the report.

Athena Series

The Athena series consists of very deep, dark-colored, well-drained soils that are of silt loam texture throughout. These soils formed in loess mixed with some volcanic ash, under a cover of grass. They occupy nearly level to very steep uplands. The annual precipitation is 15 to 18 inches, and the frost-free season is about 140 days.

Athena soils are used for grain, peas, alfalfa, and grass and as range.

Athena silt loam, 5 to 30 percent slopes (AaC).—This is the dominant soil on the silty uplands in the western and southwestern parts of the county. Most slopes are between 8 and 20 percent. Short slopes of more than 20 percent occur along the edges of drainageways. The gentle slopes are on the broad ridgetops and on foot slopes. In a few small areas, the slope is more than 30 percent and in some it is less than 5 percent. Representative profile:

- 0 to 18 inches, silt loam; very dark brown and very friable in upper 10 inches, very dark grayish brown and friable below; granular structure; neutral.
- 18 to 44 inches, dark-brown silt loam that breaks into prisms 1 to 2 inches wide; friable and mildly alkaline above a depth of 28 inches; firm, strongly alkaline, and calcareous below a depth of 28 inches.
- 44 to 60 inches, brown, friable silt loam; moderately alkaline; strongly calcareous.

In places the surface layer is nearly black. The texture of the subsoil ranges from silt loam to heavy silt loam. The depth to lime ranges from 2 to 4 feet. At the lower elevations, the subsoil, and in some places the surface layer, contains small amounts of granitic and basaltic very coarse sand, gravel, and cobblestones.

Included with this soil in mapping were many areas of eroded soils, mostly on short, sharp breaks along drainageways, that have layers of silty clay loam or silty clay near the surface (Reardan soils). Also included are areas of a soil that has a subsoil of gravelly loam or silt loam below a depth of 2 feet (Cheney soil).

This soil is well drained and moderately permeable. It holds from 9 to 11 inches of water that plants can use. It is high in fertility and easy to work. Root penetration is very deep. Surface runoff is medium, and the hazard of erosion is moderate.

Most of the acreage is cultivated. Wheat is the chief crop. In most places it is grown in a wheat-fallow rotation, but some areas are cropped annually and peas are included in the rotation. Other crops grown are barley, alfalfa for hay or green manure, and grass for pasture or hay. A few areas are used as native range. Grain and grass respond to nitrogen, and legumes respond to sulfur. Short, steep slopes limit the use of farm machinery in places. (Capability unit IIIe-1; Loamy range site; not in a woodland group)

Athena silt loam, 0 to 5 percent slopes (AaA).—The surface layer of this soil is 3 to 5 inches thicker than that of Athena silt loam, 5 to 30 percent slopes, and in most places the depth to lime is more than 50 inches. In swales or depressions the surface layer is as much as 2 feet or more in thickness. Surface runoff is slow, and the hazard of erosion is slight. Included in mapping were areas of Reardan soils, in which silty clay loam or silty clay is near the surface, and areas of Cheney soils, in which a subsoil of gravelly loam or gravelly silt loam occurs below a depth of 2 feet.

This soil is used in the same way as Athena silt loam, 5 to 30 percent slopes, but generally produces higher yields. (Capability unit IIe-1; Loamy range site; not in a woodland group)

Athena silt loam, 30 to 55 percent slopes (AaD).—On south-facing slopes, the surface layer of this soil is 3 to 7 inches thinner than that of Athena silt loam, 5 to 30 percent slopes, and the moisture-supplying capacity is slightly lower. Generally, the slopes are less than 45 percent. Runoff is rapid, and the erosion hazard is severe. Included in mapping were a few areas of Lance soils, in which lime is at or near the surface.

The same crops are grown on this soil as on Athena silt loam, 5 to 30 percent slopes, but yields are lower and more of the acreage is in grass and legumes. Using machinery is difficult on these steep slopes, and special harvesting equipment is needed. (Capability unit IVe-1, except that slopes of 40 to 55 percent are in capability unit VIe-1; south exposures in Loamy range site, north exposures in North Exposure range site; not in a woodland group)

Athena silt loam, 55 to 70 percent slopes (AaE).—This very steep soil has a northern exposure. Runoff is very rapid, and the erosion hazard is very severe. Included in mapping were small areas where the slopes are less than 55 percent.

This soil is used for grazing. (Capability unit VIIe-1; North Exposure range site; not in a woodland group)

Athena-Lance silt loams, 0 to 30 percent slopes (AlC).—From 40 to 80 percent of this mapping unit consists of Athena silt loam that has a slope range of 5 to 30 percent, and from 20 to 60 percent consists of severely eroded Lance silt loam that has a slope range of 0 to 30 percent. These soils were mapped as a complex because they are so intermingled that it is not practical to show them separately on the map. The Lance soil is like the soils described under the heading "Lance Series." (As a complex: capability unit IVe-1. By components: Athena soil—capability unit IIIe-1; Loamy range site; not in a woodland group. Lance soil—capability unit IVe-7; not in a range site or woodland group)

Athena-Lance silt loams, 30 to 55 percent slopes (AlD).—From 40 to 80 percent of this mapping unit is Athena silt loam, and from 20 to 60 percent is severely eroded Lance silt loam. These soils were mapped as a complex because they are so intermingled that it is not practical to show them separately on the map. The Lance soil is similar to the soils described under the heading "Lance Series." (As a complex: capability unit VIe-1, except that the Athena soil having slopes of less than 40 percent is in capability unit IVe-1. By components: Athena soil—southern exposures in Loamy range site, northern exposures in North Exposure range site; not in a woodland group. Lance soil—not in a woodland group or range site)

Bernhill Series

The Bernhill series consists of well-drained, medium-textured, nearly level to very steep soils. Some areas are gravelly or stony, and some are underlain by gravelly till or bedrock below a depth of about 20 inches. These soils formed in glacial till mixed in the upper part with loess and volcanic ash. They are on level to very steep uplands. The native vegetation consists of conifers and grass. The annual precipitation is 18 to 23 inches, and the frost-free season is 105 to 125 days.

Bernhill soils are used for grain, alfalfa, and grass, for pasture, and as woodland.

Bernhill silt loam, 0 to 20 percent slopes (BaB).—This is the dominant soil on the lower part of the glaciated mountain foot slopes and the hilly uplands in the north-central part of the county. Slopes are dominantly between 5 and 20 percent. Representative profile:

0 to 16 inches, very dark grayish-brown silt loam, dark brown in the lower part; friable; granular structure; slightly acid.
16 to 60 inches, dark-brown loam, dark yellowish brown in the lower part; friable to firm; breaks into prisms 2 to 4 inches thick at a depth of 29 to 45 inches; neutral.

The color of the uppermost 8 inches ranges from very dark grayish brown to very dark brown. The texture of the subsoil ranges from heavy loam to heavy silt loam. In places the subsoil contains thin, wavy bands of finer textured material. As much as 5 percent of this mapping unit may consist of Spokane loam, 0 to 30 percent slopes, or of other phases of the Bernhill series. An additional 5 percent may consist of Dearyton silt loam, 5 to 20 percent slopes.

This soil is well drained and moderately permeable. It holds about 10 inches of water that plants can use. It is medium in fertility and is easy to work. Root penetration is very deep. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Approximately 80 percent of this soil is cultivated; the rest is in ponderosa pine, lodgepole pine, and Douglas-fir. Wheat, oats, barley, alfalfa, and grass are the principal crops. Legumes respond to sulfur and boron, and all other crops respond to nitrogen. (Capability unit IIIe-2; woodland group 4; not in a range site)

Bernhill silt loam, 20 to 30 percent slopes (BaC).—This soil has medium to rapid surface runoff, and the erosion hazard is moderate to severe. Using machinery is somewhat difficult because of the slope. As much as 8 percent of some areas consists of Bernhill silt loam, moderately shallow, 0 to 20 percent slopes, of Green Bluff soils, and of Dearyton soils.

About half the acreage is cultivated. The rest is forested. (Capability unit IIIe-2; woodland group 4; not in a range site)

Bernhill silt loam, 30 to 55 percent slopes (BaD).—The surface layer of this soil is 2 to 4 inches thinner than that of Bernhill silt loam, 0 to 20 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. This soil is difficult to work because of the steep slopes. As much as 8 percent of some areas consists of Dearyton loam or of moderately shallow Bernhill silt loam.

Approximately 90 percent of this soil is forested, and the rest is seeded to grass and alfalfa for hay. (Capability unit VIe-2; woodland group 4; not in a range site)

Bernhill silt loam, moderately shallow, 0 to 20 percent slopes (BbB).—The surface layer of this soil is 2 to 4 inches thinner than that of Bernhill silt loam, 0 to 20 percent slopes. Bedrock is at a depth of 20 to 36 inches. This soil holds from 4 to 6 inches of water that plants can use. It is low in fertility. Roots penetrate to bedrock. As much as 5 percent of some areas consists of deeper Bernhill silt loam, of Bernhill gravelly silt loam, or of Spokane loam.

The same crops are grown as on Bernhill silt loam, 0 to 20 percent slopes, but yields are lower. (Capability unit IIIe-4; woodland group 8; not in a range site)

Bernhill silt loam, moderately shallow, 30 to 55 percent slopes (BbD).—The surface layer of this soil is 3 to 4 inches thinner than that of Bernhill silt loam, 0 to 20 percent slopes. Bedrock is at a depth of 20 to 36 inches. Roots penetrate to bedrock. This soil is low in fertility and holds from 4 to 6 inches of water that plants can use. Surface runoff is rapid, and the hazard of erosion is severe. Approximately 10 percent of some areas consists of other Bernhill soils or of Spokane soils.

About 10 percent of this soil is seeded to alfalfa and grass for hay; the rest is forested. (Capability unit VIe-2; woodland group 8; not in a range site)

Bernhill gravelly silt loam, 0 to 20 percent slopes (BeB).—This soil is gravelly both in the surface layer and in the subsoil. It holds 4 to 6 inches of water that plants can use. The gravel causes some difficulty in the use of farm machinery.

The same crops are grown as on Bernhill silt loam, 0 to 20 percent slopes, but yields are lower. (Capability unit IIIe-4; woodland group 8; not in a range site)

Bernhill very stony silt loam, 0 to 20 percent slopes (BfB).—This soil contains enough stones to make the use of most farm machinery impracticable. It holds about 7 inches of water that plants can use. As much as 5 percent of some areas consists of gravelly Bernhill soils. (Capability unit VIs-1; woodland group 8; not in a range site)

Bernhill very stony silt loam, 20 to 55 percent slopes (BfD).—This soil contains so many stones that the use of farm machinery is impracticable. It holds about 7 inches of water that plants can use. Surface runoff is rapid, and the hazard of erosion is severe. Approximately 5 percent of some areas consists of gravelly Bernhill soils. (Capability unit VIIs-1; woodland group 8; not in a range site)

Bernhill soils, 20 to 55 percent slopes (BhD).—This mapping unit is made up about equally of a gravelly Bernhill silt loam having a slope range of 20 to 55 percent and a moderately shallow Bernhill silt loam having a slope range of 20 to 30 percent. These soils have a thinner surface layer than Bernhill silt loam, 0 to 20 percent slopes.

Most of the acreage is forested. The rest is in small grain and in alfalfa and grass used for hay. (As a complex: capability unit VIe-2. By components: Gravelly Bernhill soil—capability unit VIe-2; woodland group 8; not in a range site. Moderately shallow Bernhill soil—capability unit IVe-4; woodland group 8; not in a range site)

Bernhill very rocky complex, 0 to 30 percent slopes (BkC).—From 25 to 50 percent of this mapping unit is made up of basalt or granite outcrops; the rest consists of Bernhill silt loam. Included also are areas of Bernhill soils that are gravelly or stony or are underlain by bedrock at a depth of 20 to 36 inches. Most of the rock outcrops are

10 to 20 feet across, and some are 20 feet high or more. Most of the acreage is forested. Small tracts are cultivated, chiefly to small grain. (As a complex: capability unit VIs–1. By components: Bernhill silt loam—capability unit IIIe–2; woodland group 4; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Bernhill very rocky complex, 30 to 55 percent slopes (BkD).—About 50 percent of this mapping unit is made up of outcrops of basalt or granite, and the rest is Bernhill silt loam. Included also are areas of Bernhill soils that are gravelly or stony or are underlain by bedrock at a depth of 20 to 36 inches. Most of the rock outcrops are 20 to 30 feet across, and some are 20 feet high or more. This unit is all forested. (As a complex: capability unit VIIs–1. By components: Bernhill silt loam—capability unit VIe–2; woodland group 4; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Bong Series

The Bong series consists of somewhat excessively drained, moderately coarse textured soils underlain by coarse sand at a depth of 20 to 40 inches. These soils formed under grass in glaciofluvial material that is mixed in the upper part with loess. The annual precipitation is 15 to 25 inches. The frost-free season is 130 to 150 days.

Bong soils are used for grain, alfalfa, and grass and for grazing.

Bong coarse sandy loam, 0 to 8 percent slopes (BoB).—This soil is on outwash plains near Fairchild Air Force Base. The annual precipitation is 15 to 17 inches. Representative profile:

0 to 10 inches, very dark brown, friable coarse sandy loam; granular structure; neutral.
10 to 30 inches, dark-brown, friable sandy loam; neutral.
30 inches +, multicolored, loose coarse sand; neutral.

In places the surface layer is very dark grayish brown. The depth to coarse sand ranges from 20 to 40 inches. There are a few stones and some gravel in the surface layer. Included with this soil in mapping were small areas of Cheney and Hesseltine silt loams.

This soil is somewhat excessively drained and has moderately rapid permeability above the coarse sand. The coarse sand has very rapid permeability. This soil holds from 3 to 6 inches of water that plants can use. It is medium in fertility and is easy to work. Root penetration is restricted by the layer of coarse sand. Surface runoff is slow, and the hazard of erosion is slight.

Most of this soil is cultivated; the rest is used as range. Wheat is the main crop. Some alfalfa and some grass are grown for hay and pasture. Legumes respond to sulfur, and all other crops to nitrogen. (Capability unit IVe–5; Shallow range site; not in a woodland group)

Bong and Phoebe fine sandy loams, 0 to 8 percent slopes (BpB).—This is the dominant soil on the outwash plains near Fairchild Air Force Base. Some areas consist almost entirely of Bong fine sandy loam, some almost entirely of Phoebe fine sandy loam, and others of both soils in varying proportions. The annual precipitation is 15 to 17 inches. Representative profile of Bong fine sandy loam:

0 to 11 inches, very dark brown, friable fine sandy loam; granular structure; neutral.
11 to 22 inches, dark-brown, friable sandy loam; neutral.
22 to 28 inches, dark-brown, friable gravelly coarse sandy loam; neutral.
28 inches +, multicolored, loose coarse sand; neutral.

The color of the surface layer ranges from very dark brown to very dark grayish brown. The texture of the subsoil ranges from coarse sandy loam to sandy loam. The depth to the underlying coarse sand ranges from 25 to 36 inches.

The Phoebe soil is similar to Bong fine sandy loam, but the depth to the coarse sand is about 40 inches. There are a few stones and some gravel in the surface layer.

As much as 5 percent of some areas consists of Cheney silt loam and Hesseltine silt loam that have a slope range of 0 to 8 percent.

The Phoebe soil is well drained, the Bong soil is somewhat excessively drained, and each has moderately rapid permeability. The Bong soil holds from 4 to 5 inches of water that plants can use, and the Phoebe soil 5 to 6 inches. Both are medium in fertility and are easy to work. Root penetration is somewhat limited by the layer of coarse sand. Surface runoff is slow, and the hazard of erosion is slight.

Approximately 70 percent of this mapping unit is cultivated; the rest is used for pasture and building sites. Wheat is the chief crop. Alfalfa, other legumes, and grass are grown for hay and pasture. All crops except legumes respond to nitrogen. Some crops, especially legumes, have responded to sulfur. (Capability unit IIIe 6; Loamy range site; not in a woodland group)

Bong and Phoebe coarse sandy loams, 0 to 20 percent slopes (BrB).—In most places these soils have a surface layer of black coarse sandy loam. Surface runoff is medium, and the erosion hazard is moderate. Included in mapping were a few areas in which the surface layer is loamy sand. The annual precipitation is 18 to 25 inches.

Most of the acreage is cultivated, and wheat, oats, barley, potatoes, alfalfa, and grass are grown. Legumes respond to sulfur, and all other crops respond to nitrogen. (Capability unit IIIe–6; Shallow range site; not in a woodland group)

Bong and Phoebe coarse sandy loams, 20 to 30 percent slopes (BrC).—The soils in this unit have medium to rapid surface runoff, and the erosion hazard is moderate to severe. Included in mapping were areas in which the surface layer is loamy sand. The annual precipitation is 18 to 25 inches.

These soils are used for grazing. A few areas are seeded to alfalfa and grass for hay or pasture. (Capability unit VIe–1; Shallow range site; not in a woodland group)

Bong and Phoebe loamy sands, 0 to 20 percent slopes (BsB).—Included with these soils in mapping were areas where the depth to coarse quartz sand is 10 to 20 inches and other areas where the surface layer is fine sandy loam. The annual precipitation is 18 to 25 inches.

Most of the acreage is cultivated. Wheat, oats, barley, potatoes, alfalfa, and grass are grown. Legumes respond to sulfur, and all other crops respond to nitrogen. (Capability unit IIIe–5; Shallow range site; not in a woodland group)

Bonner Series

The Bonner series consists of well-drained, medium-textured and moderately coarse textured soils underlain by sand or gravelly sand at a depth of 18 to 36 inches. These soils are on nearly level to moderately steep terraces. They formed in glacial outwash material mixed with loess and volcanic ash. The native vegetation is coniferous forest. The annual precipitation is 20 to 23 inches, and the frost-free season is 100 to 140 days.

Bonner soils are used for grain, alfalfa, and grass and as woodland.

Bonner silt loam, 0 to 8 percent slopes (BtB).—This is one of the dominant soils on terraces in the glaciated valley in the northern part of the county. Representative profile:

0 to 10 inches, dark-brown, very friable silt loam; granular structure in the upper 2 inches; neutral. In undisturbed areas an organic mat 1 inch thick is on the surface.

10 to 26 inches, dark-brown, friable gravelly loam, mottled with dark brown; dark yellowish-brown gravelly coarse sandy loam at a depth of 20 inches; slightly acid.

26 to 60 inches +, multicolored, loose gravelly coarse sand; neutral.

The texture of the surface layer ranges from silt loam to loam, and the color from dark brown to dark yellowish brown. The amount of gravel in the surface layer ranges from 5 to 20 percent. The depth to gravelly sand is 20 to 36 inches. In a few areas the slope is as much as 20 percent. As much as 5 percent of some areas consists of other Bonner soils.

This soil is well drained. It is moderately permeable above the gravelly sand, but very rapidly permeable in that layer. It holds 5 or 6 inches of water that plants can use. Fertility is low. In general, roots can penetrate only a few inches into the gravelly sand. This soil is easy to work. Surface runoff is slow, and the hazard of erosion is slight.

Most of this soil is forested. Small, cleared areas are used for small grain or are seeded to alfalfa and grass for hay. Grass and grain crops respond to nitrogen, and nitrogen helps in establishing mixed stands of alfalfa and grass. Some crops, especially legumes, respond to sulfur and phosphorus. (Capability unit IVe–6; woodland group 11; not in a range site)

Bonner gravelly silt loam, 0 to 20 percent slopes (BuB).—This gravelly soil holds slightly less water than Bonner silt loam, 0 to 8 percent slopes. Included in mapping were small areas that are free of gravel.

Most of this soil is forested. A few areas are seeded to alfalfa and grass for hay and pasture. Nitrogen helps to establish alfalfa and grass. Alfalfa also responds to sulfur and phosphorus. (Capability unit VIe–2; woodland group 13; not in a range site)

Bonner loam, 0 to 20 percent slopes (BvB).—This is the dominant soil on the glacial outwash terraces immediately east of Deer Park. Most slopes are between 0 and 5 percent, but those in a few small areas are in excess of 20 percent. Most of the slopes of more than 10 percent are along terrace breaks. Coarse sand is at a depth of 18 to 36 inches. In some places the subsoil contains a few, thin, wavy bands of material that is finer textured than the surrounding material. Also, the subsoil in some places is sandy loam and is as much as 10 percent gravel. Five percent of some areas consists of Hagen sandy loam, 0 to 20 percent slopes, and Eloika silt loam, 0 to 20 percent slopes.

Most of this soil is cleared and used for alfalfa, grass, and small grain. Yields are low. All grain and grass crops respond to nitrogen, and nitrogen helps in establishing legumes. Alfalfa responds to sulfur and boron. (Capability unit IVe–6; woodland group 11; not in a range site)

Bonner fine sandy loam, 0 to 20 percent slopes (BwB).—This soil holds slightly less water available for plants than Bonner loam, 0 to 20 percent slopes.

Most of this soil is in ponderosa pine and lodgepole pine; less than 40 percent is cleared. Cleared areas are used for alfalfa, grass, and small grain. Yields are low. All grain and grass crops respond to nitrogen and phosphorus, and these fertilizers also help in establishing legumes. Alfalfa responds to sulfur and boron. (Capability unit IVe–6; woodland group 13; not in a range site)

Brickel Series

The Brickel series consists of well-drained, medium-textured, stony soils underlain by bedrock at a depth of 14 to 36 inches. These soils occur mostly in steeply sloping areas high in the mountains. They formed in weathered granite mixed in the upper part with volcanic ash. The vegetation consists of grass, sedges, shrubs, and scattered alpine firs. The annual precipitation is 35 to 45 inches, and the frost-free season is about 45 days.

The Brickel soils are used for recreational purposes, as wildlife habitats, and as watersheds.

Brickel stony loam, 20 to 55 percent slopes (BxD).—The largest body of this soil is in a nearly treeless area on Mount Spokane. Most slopes are between 25 and 45 percent. Representative profile:

0 to 13 inches, black, very friable stony loam; granular structure; slightly acid.

13 to 22 inches, dark-brown, very friable cobbly and gravelly loam; slightly acid.

22 to 30 inches, dark-brown, very friable, very cobbly sandy loam; slightly acid.

30 inches +, fractured, partly weathered, fine-grained gneiss bedrock.

The surface layer ranges from 10 to 14 inches in thickness, and from stony loam to stony silt loam in texture. From 50 to 90 percent of the subsoil in some places consists of gneiss, stones, cobblestones, and gravel. The depth to bedrock in most places is 14 to 36 inches. As much as 7 percent of some areas consists of Vassar silt loam, 30 to 55 percent slopes.

This soil is well drained and moderately permeable. It holds from 3 to 5 inches of water that plants can use. Fertility is medium. Roots penetrate the bedrock. Surface runoff is rapid, and the hazard of erosion is severe.

All of this soil is in grass, shrubs, and scattered alpine firs. It is too steep and stony for cultivation and is used for recreational purposes, as wildlife habitats, and as watersheds. (Capability unit VIs–2; not in a woodland group or range site)

Bridgeson Series

The Bridgeson series consists of poorly drained and somewhat poorly drained soils that have a mottled clay loam or silty clay loam subsoil. These soils are in nearly

level areas along drainageways. They formed under water-tolerant grass, reeds, and rushes, in silty alluvium that is of mixed mineralogy and includes some volcanic ash. The annual precipitation is about 22 inches, and the frost-free season is about 90 days.

Bridgeson soils are used for grass, legumes, and grain, for grazing, and as wildlife habitats.

Bridgeson silt loam (By).—This is the dominant soil along drainageways in the northern part of the county. The slopes range from 0 to 5 percent. Representative profile:

0 to 12 inches, very dark gray; friable silt loam; granular structure; neutral.
12 to 31 inches, dark-gray, friable heavy silt loam in the upper part, light silty clay loam with a few dark-brown mottles in the lower part; neutral.
31 to 60 inches, dark-gray, very firm silty clay loam with dark-brown mottles; heavy silty clay loam with bluish-gray mottles below a depth of 40 inches; neutral.

The surface layer ranges from very dark brown to black. The subsoil ranges from clay loam to silty clay loam and contains a few lenses of sand or pumice. During the year, the depth to the water table varies from near the surface to 3 feet below the surface. As much as 5 percent of some areas consists of Narcisse silt loam, 0 to 5 percent slopes, or Peone silt loam, 0 to 5 percent slopes.

This soil is poorly drained. It is saturated at least 8 months of the year, and in many places water stands on the surface; consequently, the use of farm machinery is limited. Overflow often leaves fresh soil material on the surface, especially near drainageways. This soil can hold about 11 inches of water that plants can use. The permeability of the subsoil is moderate, and that of the substratum is slow. The fertility is high. Root penetration is limited by the water table and by the heavy silty clay loam substratum.

Less than 5 percent of the acreage is cultivated. Most of it is in water-tolerant grass, reeds, rushes, and shrubs and is used for pasture. Improved pasture is seeded to water-tolerant grass and legumes. Crops respond to nitrogen and may also respond to other fertilizers. (Capability unit IVw–1; Wet Meadow range site; not in a woodland group)

Bridgeson silt loam, drained (Bz).—The drainage of this soil has been improved by natural stream cutting and by the use of open drainage ditches and is now somewhat poor rather than poor. In most places this soil is saturated for 2 or 3 months early in spring. As a consequence, the use of machinery is limited. As much as 3 percent of some areas consists of Narcisse or Peone soils.

Most of the acreage is cultivated. Some is seeded to pasture, and some to spring grain. Crops respond to nitrogen. (Capability unit IIIw–2; not in a woodland group or range site)

Caldwell Series

The Caldwell series consists of somewhat poorly drained soils that have a silt loam surface layer and a mottled heavy silt loam or silty clay loam subsoil. These soils occur in nearly level areas along streams. They formed in silty alluvium that is of mixed mineralogy and includes volcanic ash. The native vegetation consisted mostly of grass and shrubs. The annual precipitation is 18 to 22 inches, and the frost-free season is about 110 days.

Caldwell soils are used mostly for grain, alfalfa, and grass.

Caldwell silt loam (Ca).—This is the dominant soil on alluvial bottoms within areas of Palouse soils, which are on uplands. Most slopes are nearly level; a few are as steep as 5 percent. Representative profile:

0 to 38 inches, very dark gray, friable silt loam; soil breaks into plates 1/10 to 1/8 inch thick and, below a depth of 25 inches, into subangular blocks 1/4 to 1/2 inch wide; neutral.
38 to 52 inches, very dark gray, firm silty clay loam, faintly mottled; neutral.
52 to 60 inches, dark grayish-brown, firm silty clay loam with dark-brown and strong-brown mottles; neutral.

In places the surface layer is very dark grayish brown or black. The texture of the subsoil ranges from heavy silt loam to silty clay loam, and the mottles are faint to distinct. In some places basalt bedrock occurs at a depth of 48 to 60 inches. As much as 5 percent of some areas consists of Latah silt loam and as much as 3 percent of Snow silt loam. Both of these soils have a slope range of 0 to 5 percent.

This soil is somewhat poorly drained and has moderately slow permeability in the subsoil. It holds about 11 inches of water that plants can use. The fertility is high. Root penetration is very deep. Floods of short duration are common in the spring, and during these floods, fresh material is deposited on the surface in places. Although tillage often has to be delayed in spring because of wetness, this soil is easy to work. Surface runoff is slow, and there is little or no hazard of erosion.

More than 95 percent of the acreage is cultivated; the rest is used as grassed waterways. Wheat is the chief cash crop. It is grown in rotation with grass and alfalfa. Other crops grown are barley and oats. Yields of all crops are high if management is good. Grass and grain crops respond to nitrogen; legumes respond to sulfur. (Capability unit IIw–1; Bottomland range site; not in a woodland group)

Cedonia Series

The Cedonia series consists of well-drained, medium-textured, nearly level to moderately steep soils that formed in calcareous glacial lake sediments that included volcanic ash. The native vegetation consisted of ponderosa pine, lodgepole pine, tamarack (larch), and scattered Douglas-firs, along with pinegrass and wheatgrass. The annual precipitation is 18 to 21 inches, and the frost-free season is about 135 days.

These soils are used for grain, grass, and legumes, as woodland, and as farmsteads.

Cedonia silt loam, 0 to 5 percent slopes (CeA).—This is the dominant soil that formed in glacial lake sediments on Peone Prairie and in other areas in the central part of the county. Most slopes are between 2 and 5 percent. Representative profile:

0 to 12 inches, dark grayish-brown, friable silt loam; granular structure; neutral.
12 to 33 inches, dark-brown, friable silt loam that contains fine, dark yellowish-brown, thin, wavy bands; mildly alkaline in the upper part and moderately alkaline below; slightly effervescent in some root channels.
33 to 60 inches, olive, friable silt loam that breaks into laminated layers 1/16 to 1/8 inch thick; strongly alkaline; strongly effervescent.

The color of the surface layer ranges from dark grayish brown to very dark grayish brown, and the texture from very fine sandy loam to silt loam. As much as 4 percent of some areas consists of Snow silt loam and Bernhill silt loam.

This soil is well drained and moderately permeable. It holds 9 to 11 inches of water that plants can use. It is medium in fertility and is easy to work. Root penetration is deep. Roots penetrate the laminated layers mostly along cleavage planes. Surface runoff is slow, and the hazard of erosion is slight.

More than 95 percent of the acreage is cultivated; the rest is woodland or farmsteads. Wheat and barley are the principal crops. Other crops grown are alfalfa, grass for seed, and peas for green manure. All crops except legumes respond to nitrogen. Some crops, especially legumes, respond to sulfur and phosphorus. (Capability unit IIe–2; woodland group 3; not in a range site)

Cedonia silt loam, 5 to 20 percent slopes (CeB).—This soil has a surface layer 2 to 4 inches thinner than that of Cedonia silt loam, 0 to 5 percent slopes. Surface runoff is medium, and the erosion hazard is moderate. As much as 3 percent of some areas consists of Snow or Bernhill soils or other soils of the Cedonia series.

Nearly all of this soil is cultivated. The same crops are grown on it as on Cedonia silt loam, 0 to 5 percent slopes, but yields are slightly less. (Capability unit IIIe–2; woodland group 3; not in a range site)

Cedonia silt loam, 20 to 30 percent slopes, severely eroded (CeC3).—This soil is along drainageways. Its surface layer is 5 to 7 inches thinner than that of Cedonia silt loam, 0 to 5 percent slopes, and lime is nearer the surface than in the nearly level phase. As much as 2 percent of some areas consists of Snow or Bernhill soils.

This soil holds about 9 inches of water that plants can use. The fertility is low to medium. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

This soil should be kept in grass and legumes most of the time. Small grain can be grown, but yields are lower than on Cedonia silt loam, 0 to 5 percent. (Capability unit IV–3; woodland group 3; not in a range site)

Cheney Series

This series consists of well-drained, medium-textured, mostly gravelly or stony soils underlain by coarse sand, gravel, or cobblestones at a depth of 20 to 40 inches. These soils formed under grass in glacial outwash mixed with loess and volcanic ash. They are nearly level to moderately steep. The annual precipitation is 15 to 18 inches, and the frost-free season is about 130 days.

Cheney soils are used for grain, peas, alfalfa, and grass and for grazing.

Cheney gravelly silt loam, 0 to 8 percent slopes (CgB).—This soil occurs on a glacial outwash plain underlain by basalt in the western and southwestern parts of the county. Representative profile:

0 to 14 inches, very dark brown, very friable gravelly silt loam; granular structure in upper part and platy in lower part; neutral.
14 to 28 inches, dark-brown, very friable, gravelly silt loam; neutral.
28 to 35 inches, dark-brown, very friable, very gravelly sandy loam; mildly alkaline.
35 inches +, nearly clean gravel and cobblestones, dominantly basalt.

In places the layer above the gravel and cobblestones is gravelly loam, and it may contain lime. In some areas the surface layer is free of gravel.

This soil is well drained and moderately permeable. It holds 4 to 6 inches of water that plants can use. The fertility is medium, and workability is fair to good. Roots of most plants penetrate only to the gravel and cobblestones. Surface runoff is slow, and the hazard of erosion is slight.

Much of the acreage is cultivated, and the rest is used for grazing. Wheat is the chief crop. Generally wheat is grown in a wheat-fallow rotation, but sometimes dry field peas are included in the rotation. Other crops grown are barley, alfalfa for hay or green manure, and grass for pasture or hay. All crops except legumes respond to nitrogen; legumes respond to sulphur and phosphorus. (Capability unit IVe–5; Shallow range site; not in a woodland group)

Cheney stony silt loam, 0 to 20 percent slopes (ChB).—As much as 5 percent of some areas of this soil consists of Hesseltine stony silt loam, 0 to 20 percent slopes.

This soil is used for grazing. None of it is cultivated. (Capability unit VIs–2; Shallow range site; not in a woodland group)

Cheney very rocky complex, 0 to 30 percent slopes (CkC).—From 50 to 80 percent of this mapping unit is Cheney stony silt loam that has a slope range of 0 to 20 percent; the rest consists mostly of basalt outcrops and unnamed very stony, very shallow soils.

The soils of this complex are used as range. Some areas of the Cheney stony silt loam are seeded to pasture. (As a complex: capability unit VIIs–2. By components: Cheney soil—capability unit VIs–2, Shallow range site, not in a woodland group; Basalt outcrops—capability unit VIIIs–1, not in a range site or woodland group)

Cheney extremely rocky complex, 0 to 30 percent slopes (CmC).—From 20 to 50 percent of this mapping unit consists of Cheney stony silt loam that has a slope range of 0 to 20 percent, and the rest of basalt outcrops and unnamed very shallow soils. This complex is used for grazing. (As a complex: capability unit VIIs–2. By components: Cheney soil—capability unit VIs–2; Shallow range site; not in a woodland group. Basalt outcrops—capability unit VIIIs–1; not in a range site or woodland group)

Cheney and Uhlig silt loams, 0 to 8 percent slopes (CnB).—These are the dominant soils on the grassland of the glacial outwash plain in the western and southwestern parts of the county. Most slopes are between 3 and 8 percent, though the Cheney soil has a slope range of 0 to 8 percent and the Uhlig soil a range of 0 to 5 percent. An individual area may consist almost entirely of one of these soils or of varying proportions of both. The annual precipitation is 15 to 18 inches. Representative profile of Cheney silt loam:

0 to 14 inches, very dark brown, very friable silt loam; granular structure in upper 10 inches; neutral.
14 to 28 inches, dark-brown, very friable silt loam; neutral.
28 to 35 inches, dark-brown, loose very gravelly sandy loam; mildly alkaline.
35 inches +, nearly clean gravel and cobblestones.

In places the surface layer contains some gravel. The texture of the 28- to 35-inch layer ranges from very gravelly sandy loam to gravelly loam. This layer may contain lime. The Uhlig soil is similar to the Cheney soil, but the gravel and cobblestones are below a depth of 40 inches. As much as 10 percent of some areas of this mapping unit consists of Reardan, Athena, Bong, or Phoebe soils.

Cheney and Uhlig soils are well drained and moderately permeable. The Cheney soil holds from 4 to 5 inches of water that plants can use, and the Uhlig soil 5 to 6 inches. Fertility is medium, and workability is good. The roots of most plants penetrate only to the gravel and cobblestone layer. Surface runoff is slow, and the hazard of erosion is slight.

Approximately 85 percent of the acreage is cultivated; the rest is used for grazing. Wheat is the chief cash crop. Ordinarily, wheat is grown in a wheat-fallow rotation. Sometimes dry field peas are included in the rotation. Other crops grown are barley, alfalfa for hay or green manure, and grass for pasture or hay. All crops except legumes respond to nitrogen; legumes sometimes respond to sulfur and phosphorus. (As a complex: capability unit IIIe–6. By components: Cheney soil—capability unit IIIe–6; Shallow range site; not in a woodland group. Uhlig soil—capability unit IIe–1; Loamy range site; not in a woodland group)

Cheney-Uhlig complex, 0 to 8 percent slopes (CoB).—From 50 to 80 percent of this mapping unit is Cheney stony silt loam that has a slope range of 0 to 8 percent, and from 20 to 50 percent is Uhlig silt loam that has a slope range of 0 to 5 percent. The Uhlig soil occurs as mounds, or "biscuits," generally 20 to 40 feet in diameter and about 2 feet high. As much as 10 percent of some areas consists of Hesseltine soils.

Most of the acreage is used for grazing. A few of the larger mounds are used for wheat, barley, rye, and alfalfa. (Capability unit VIs–2; Shallow range site; not in a woodland group)

Clayton Series

The Clayton series is made up of well-drained and somewhat excessively drained soils that have a sandy loam subsoil and a loamy sand or sand substratum. These soils formed in glaciofluvial deposits mixed with volcanic ash, under conifers and shrubs. They are nearly level to moderately steep. The annual precipitation is 20 to 23 inches, and the frost-free season is about 110 days.

Clayton soils are used for grain, alfalfa, grass, and potatoes, and as woodland.

Clayton fine sandy loam, 0 to 5 percent slopes (CsA).—This is the dominant soil on the outwash terraces in the northwestern part of the county. Most slopes are between 2 and 5 percent. Representative profile:

0 to 9 inches, very friable fine sandy loam; dark brown and medium acid in the upper part, dark yellowish brown and slightly acid in lower part; granular structure.

9 to 35 inches, very friable sandy loam; dark brown and slightly acid above a depth of 18 inches, brown and neutral below that depth; two wavy bands of dark-brown loam, 1/16 to 1/8 inch thick, at a depth between 18 and 35 inches.

35 to 74 inches +, brown, very friable loamy fine sand underlain at a depth of 54 inches by brown sand; several wavy bands of dark-brown loam, 1/16 inch to 2 inches thick, at a depth between 35 and 74 inches; neutral.

Undisturbed areas of this soil have a 1-inch mat of organic matter on the surface. The color of the uppermost 9 inches ranges from brown to dark brown, and the structure from weak granular to weak platy. The texture of the subsoil ranges from fine sandy loam to sandy loam. The number of bands in the subsoil varies between 4 and 10, and the thickness of the bands ranges from 1/16 inch to 2½ inches. Faint, dark-brown mottles and a few small pebbles commonly occur in the subsoil. In a few places bedrock is at a depth of 36 to 60 inches. As much as 5 percent of some areas consists of Phoebe, Hagen, or Bonner soils.

This soil is well drained and moderately permeable. It holds from 7 to 8 inches of water that plants can use. It is medium in fertility and is easy to work. Root penetration is very deep. Surface runoff is slow, and the hazard of water erosion is slight.

Most of the acreage is cultivated; the rest is woodland. Wheat and alfalfa are the chief crops. An alfalfa-grain rotation is generally followed. Other crops grown are oats, barley, and potatoes. Grass is also grown for hay and pasture. Grass and legume crops respond to nitrogen. Some crops, especially legumes, respond to sulfur. Boron may be deficient in places. (Capability unit IIe–6; woodland group 3; not in a range site)

Clayton fine sandy loam, 5 to 20 percent slopes (CsB).—This soil has more scattered gravel in the subsoil than Clayton fine sandy loam, 0 to 5 percent slopes. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate. As much as 5 percent of some areas consists of Phoebe, Hagen, or Bonner soils.

The use of this soil is similar to that of Clayton fine sandy loam, 0 to 5 percent slopes, but alfalfa and grass are grown more commonly because of the steeper slopes and the greater erosion hazard. (Capability unit IIIe–5; woodland group 3; not in a range site)

Clayton loam, 0 to 5 percent slopes (CtA).—As much as 5 percent of some areas of this soil consists of Clayton fine sandy loam or of Bonner or Hagen soils.

More than 80 percent of the acreage is cultivated; the rest is woodland. The same crops are grown as on Clayton fine sandy loam, 0 to 5 percent slopes. (Capability unit IIe–6; woodland group 3; not in a range site)

Clayton loam, 5 to 20 percent slopes (CtB).–Surface runoff is slow to medium on this soil, and the hazard of erosion is slight to moderate. As much as 5 percent of some areas consists of Bonner, Hagen, or other Clayton soils.

More than 80 percent of the acreage is cultivated; the rest is woodland. The use of this soil is similar to that of Clayton fine sandy loam, 0 to 5 percent slopes, but alfalfa and grass are grown more commonly because of the steeper slopes and the moderate hazard of water erosion. (Capability unit IIIe–5; woodland group 3; not in a range site)

Clayton sandy loam, 0 to 8 percent slopes (CuB).—This soil has a surface layer of very dark grayish-brown sandy loam and is underlain by sand at a depth of 36 to 48 inches. There are a few dark-brown, wavy bands in the lower subsoil. This soil is somewhat excessively drained. It holds 5 to 6 inches of water that plants can use. The roots of most plants penetrate only to the sand. As much as 10 percent of some areas is Marble sandy loam, 0 to 8 percent slopes, or Springdale gravelly sandy loam, 0 to 20 percent slopes.

About 30 percent of the acreage is cultivated. Wheat, alfalfa, and grass are grown. Wheat and grass crops respond to nitrogen. Legumes respond to sulfur. (Capability unit IVe-5; woodland group 15; not in a range site)

Cocolalla Series

The Cocolalla series consists of dark-colored, poorly drained and somewhat poorly drained, medium-textured and moderately fine textured soils in basins and potholes of the channeled scablands. These soils formed in volcanic ash mixed with silty alluvium, under sedges, rushes, and grasses. The annual precipitation is 15 to 18 inches, and the frost-free season is about 100 days.

Soils of the Cocolalla series are used for spring grain, grass, and legumes and for grazing.

Cocolalla silty clay loam (Cw).—This is the dominant soil in the nearly level basins and potholes of the channeled scablands, which are mainly in the southwestern part of the county. Representative profile:

0 to 13 inches, black, friable silty clay loam; medium, platy structure grading to fine, platy structure below a depth of 5 inches; neutral to mildly alkaline.

13 to 46 inches, dark-gray, friable silt loam grading to light brownish gray at a depth of 26 inches; mildly alkaline.

46 to 62 inches, very dark gray, friable silty clay loam underlain by light brownish-gray, friable clay loam at a depth of 56 inches; mildly alkaline.

The surface layer is very dark brown or black. The subsoil is stratified with layers of silt loam, heavy silt loam, and silty clay loam, and it contains one or more layers of pumicite. The mottling ranges from faint to prominent. The reaction ranges from slightly acid to mildly alkaline. As much as 5 percent of this mapping unit may consist of Semiahmoo muck or of Emdent silt loam.

This soil is poorly drained and moderately permeable. It holds about 11 inches of water that plants can use and is saturated about 7 months of the year. Except when saturated, it is easy to work. Fertility is high. Root penetration is limited by the excess water. Surface runoff is very slow; in many places water ponds on the surface, and some areas are subject to overflow. There is little or no hazard of erosion.

Less than 5 percent of the mapping unit is cultivated. Most of the acreage is native range or improved pasture consisting of water-tolerant legumes and grass (fig. 2). Wetness limits the use of machinery. Crops respond to nitrogen. (Capability unit Vw-1; Wet Meadow range site; not in a woodland group)

Cocolalla silty clay loam, drained (Cy)—As a result of artificial drainage, this soil is somewhat poorly drained rather than poorly drained. It is saturated for 2 or 3 months early in spring. Surface runoff is slow or very slow. As much as 5 percent of some areas consists of Hardesty or Emdent soils.

Approximately 60 percent of the acreage is cultivated; the rest is native or improved pasture. Spring grain is the major crop; grass and legumes are grown for hay or pasture. The use of machinery is limited when the soil is saturated. Grass and grain crops respond to nitrogen. Legumes may need sulfur and boron. (Capability unit IVw-2; Wet Meadow range site; not in a woodland group)

Figure 2.—Pond on Cocolalla silty clay loam in the Wet Meadow range site.

Dearyton Series

The Dearyton series consist of well drained and moderately well drained soils that have a subsoil of heavy clay loam to silty clay. These soils formed in a mantle of loess and volcanic ash over glacial till or residuum from granitic rocks. The native vegetation consists of conifers. These soils are nearly level to steep. The annual precipitation is about 23 inches, and the frost-free season is about 135 days.

Dearyton soils are used for grain, alfalfa, grass, and vegetables, for apple orchards, and as woodland.

Dearyton silt loam, 5 to 20 percent slopes (DaB).—This soil occurs on foot slopes and in gently sloping, plateaulike areas. Representative profile:

0 to 7 inches, very dark grayish-brown, very friable silt loam (nearly loam) ; granular structure; neutral.
7 to 11 inches, dark grayish-brown, friable loam; neutral.
11 to 25 inches, brown, friable loam that breaks into blocks ½ inch to 2 inches wide; slightly acid or neutral.
25 to 60 inches, brown, firm light clay or clay loam that breaks into prisms 2 to 3 inches wide and then into ¼-inch to ½-inch angular blocks; clay films coat the prisms and angular blocks; neutral; brown, neutral, very firm gravelly clay loam at a depth of 46 inches.

The surface layer ranges from very dark grayish brown to dark brown in color and from 5 to 8 inches in thickness. The texture of the subsoil ranges from silty clay to heavy clay loam. In the lower subsoil the content of gravel and cobblestones is 10 to 25 percent. As much as 10 percent of some areas consists of Bernhill, Green Bluff, or Nez Perce soils.

This soil is well drained and slowly permeable. It is medium in fertility and holds about 5 to 7 inches of water that plants can use. It is saturated late in winter and early in spring. Roots penetrate the subsoil mainly along cracks. Surface runoff is medium, and the hazard of erosion is moderate.

About 90 percent of the acreage is cultivated; the rest is forest or seeded pasture. The principal crops are small grain, apples, and vegetables, and alfalfa and grass grown for seed. There is little difficulty in the use of machinery, except when the soil is saturated. Grass and grain crops respond to nitrogen; wheat may respond to sulfur. (Capability unit IIIe–3; woodland group 5; not in a range site)

Dearyton silt loam, 0 to 5 percent slopes (DaA).—This soil has a slightly thicker surface layer than Dearyton silt loam, 5 to 20 percent slopes. It is moderately well drained and is wet for a few weeks in the spring. Surface runoff is slow, and the erosion hazard is slight. In a few places bedrock is within 24 to 40 inches of the surface. As much as 10 percent of some areas consists of Bernhill, Green Bluff, or Nez Perce soils.

Much the same crops are grown as on Dearyton silt loam, 5 to 20 percent slopes, and yields are slightly higher. (Capability unit IIw–2; woodland group 5; not in a range site)

Dearyton silt loam, 20 to 40 percent slopes (DaC).—This soil has a surface layer 2 to 3 inches thinner than that of Dearyton silt loam, 5 to 20 percent slopes, and its water-holding capacity is slightly lower. Surface runoff is rapid, and the erosion hazard is severe. As much as 10 percent of some areas consists of Bernhill soils, Green Bluff soils, or less steep Dearyton soils.

The same crops are grown as on Dearyton silt loam, 5 to 20 percent slopes, but more of the acreage is in grass and legumes. Yields are slightly lower. (Capability unit IVe–2; woodland group 5; not in a range site)

Dearyton silt loam, thin solum variant, 0 to 20 percent slopes (DeB).—This soil is only 24 to 40 inches deep over basalt, granite, gneiss, or schist. Its surface layer is 2 to 4 inches thinner than that of Dearyton silt loam, 5 to 20 percent slopes. Surface runoff is medium, and the erosion hazard is moderate or severe. Roots penetrate the subsoil mainly along cracks. About 10 percent of some areas consists of Hesseltine or Bernhill soils.

The same crops are grown as on Dearyton silt loam, 5 to 20 percent slopes, but yields are lower. (Capability unit IIIe–3; woodland group 16; not in a range site)

Dragoon Series

The Dragoon series is made up of well-drained, nearly level to steep soils underlain by bedrock at a depth of 20 to 40 inches. In many places these soils are stony or rocky. They formed under grass and conifers in weathered granite, gneiss, or schist that was mixed in the upper part with loess and volcanic ash. Dragoon soils are in hilly and mountainous areas. The annual precipitation is 15 to 18 inches. The frost-free season is about 140 days.

Dragoon soils are used for grain, grass, and legumes, for grazing, as wildlife habitats, and as woodland.

Dragoon silt loam, 0 to 30 percent slopes (DrC).—This is the dominant cultivated soil in the granitic areas in the western part of the county. Most slopes are between 5 and 20 percent; a few are steeper. Representative profile:

0 to 11 inches, very dark brown, friable silt loam or loam; granular structure; neutral.
11 to 27 inches, dark-brown, firm heavy loam that breaks into prisms 1 to 2 inches wide; neutral.
27 to 36 inches +, variegated dark yellowish-brown, brown, and light-gray, friable coarse sandy loam; neutral; underlain by granite at a depth of 36 inches.

The color of the surface layer ranges from very dark brown to black. The texture of the subsoil may be heavy silt loam, heavy loam, or light clay loam. The depth to bedrock ranges from 20 to 40 inches. As much as 8 percent of some areas consists of Athena or Reardan soils.

This soil is well drained and moderately permeable. It holds 5 to 7 inches of water that plants can use. It is easy to work except when saturated for a few days in the spring. Roots penetrate through fractures in the bedrock. The fertility is medium. Surface runoff is medium, and the hazard of erosion is moderate.

About 85 percent of the acreage is cultivated; the rest is used for grazing and as woodlots. Wheat is the chief crop. In most places it is grown in a wheat-fallow rotation, but in some places it is grown annually. Other crops grown are small grain, alfalfa for hay or green manure, and grass for hay or pasture. Grass and grain crops respond to nitrogen, and some crops, especially legumes, respond to sulfur. (Capability unit IIIe–1; woodland group 8; not in a range site)

Dragoon stony silt loam, 0 to 30 percent slopes (DsC).—This soil is like Dragoon silt loam, 0 to 30 percent slopes, except for having a stony surface layer. A few areas that are free of stones were included in mapping.

This soil is used for grazing, as woodland, and as a wildlife habitat. (Capability unit VIs–1; woodland group 8; not in a range site)

Dragoon stony silt loam, 30 to 55 percent slopes (DsD).—This soil is like Dragoon silt loam, 0 to 30 percent slopes, except for having a stony surface layer and stronger slopes. Surface runoff is rapid; and the hazard of erosion is severe. A few areas that are free of stones were included in mapping.

This soil is used for grazing, as woodland, and as a wildlife habitat. (Capability unit VIs–1; woodland group 8; not in a range site)

Dragoon very rocky complex, 20 to 55 percent slopes (DvD).—This mapping unit is 20 to 60 percent granite, gneiss, or schist outcrops; the rest is a shallow Dragoon silt loam. This shallow soil is similar to Dragoon silt loam, 0 to 30 percent slopes, but is underlain by bedrock at a depth of 10 to 20 inches. Some areas have slopes of less than 20 percent.

The acreage is used for grazing, as woodland, and as wildlife habitats. (As a complex: capability unit VIIs–2. By components: Dragoon soil—capability unit VIe–2; woodland group 8; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or a range site)

Eloika Series

The Eloika series consists of well-drained, medium-textured soils that formed under coniferous forest in glacial till mixed in the upper part with volcanic ash. These soils are undulating to very steep, and much of the acreage is stony. The annual precipitation is about 23 inches. The frost-free season is about 80 days.

Eloika soils are used for alfalfa, grass, and grain, as woodland, and for grazing.

Eloika silt loam, 0 to 20 percent slopes (EkB).—This is the dominant soil in the glaciated area along the northern border of Spokane County. Most slopes are between 3 and 8 percent. Representative profile:

- 0 to 14 inches, dark-brown, very friable silt loam; subangular blocky structure; slightly acid; undisturbed areas have an organic mat 1 inch thick on the surface.
- 14 to 44 inches, dark-brown, friable loam, brown gravelly loam in lower part; slightly acid.
- 44 to 53 inches, brown, friable very gravelly sandy loam; slightly acid.
- 53 to 60 inches +, multicolored very gravelly sandy loam; neutral.

There may be a gray layer 1/8 to 1 inch thick immediately below the surface litter. The color of the subsoil ranges from dark brown to dark yellowish brown. The depth to the very gravelly material ranges from 30 to more than 60 inches. The gravel content of the layer above may be as much as 10 percent. As much as 5 percent of some areas consists of Clayton or Bonner soils.

This soil is well drained and moderately permeable. It holds 7 or 8 inches of water that plants can use. It is medium in fertility and is easy to work. Root penetration is very deep. Surface runoff is medium, and the hazard of erosion is moderate.

Cleared areas are used mainly for small grain or for alfalfa hay. A small acreage is irrigated. All grain and grass crops respond to nitrogen. Alfalfa responds to boron and sulfur, and nitrogen helps to establish the stand. This soil is also used for timber, mainly ponderosa pine, lodgepole pine, Douglas-fir, and tamarack (larch). (Capability unit IIIe–5; woodland group 12; not in a range site)

Eloika very stony silt loam, 0 to 30 percent slopes (ElC).—This soil holds 5 or 6 inches of water that plants can use. Included in mapping were a few areas that are free of stones. This soil is too stony to be cultivated and is used for timber and for limited grazing. (Capability unit VIs–1; woodland group 12; not in a range site)

Eloika very stony silt loam, 30 to 55 percent slopes (ElD).—This soil holds 5 or 6 inches of water that plants can use. Surface runoff is rapid, and the hazard of erosion is severe. Included in mapping were a few areas that have slopes of less than 30 percent. This soil is used for timber and for limited grazing. (Capability unit VIIs–1; woodland group 12; not in a range site)

Emdent Series

The Emdent series is made up of dark-colored, somewhat poorly drained, alkaline soils in basins and potholes of the channeled scablands. These soils formed in alluvium consisting mainly of volcanic ash and diatomite, under sedges, saltgrass, and shrubs. The annual precipitation is 15 to 18 inches, and the frost-free season is about 130 days.

The Emdent soils are used for grain, alfalfa, and grass, for grazing, and as wildlife habitats.

Emdent silt loam (Em).—This is the alkaline soil in the basins and potholes of the channeled scablands. Representative profile:

- 0 to 22 inches, black, friable silt loam, very dark brown at a depth of 18 inches; granular structure; strongly alkaline; violently effervescent above a depth of 18 inches.
- 22 to 41 inches, dark-brown, friable silt loam, pale brown at a depth of 26 inches; moderately alkaline.
- 41 to 60 inches +, very dark brown, firm light silty clay loam; olive-gray, firm sandy clay loam at a depth of 47 inches; neutral.

The color of the surface layer ranges from black to very dark brown, and in some places the texture is silty clay loam. The reaction in the surface layer ranges from moderately to strongly alkaline. In some places the subsoil contains one or more layers of pumicite or diatomite; these layers range in thickness from 2 to 15 inches. The subsoil may contain lenses of very fine sandy loam or loam. Mottles in the subsoil are faint to distinct. As much as 5 percent of some areas consists of Cocolalla soils.

This soil is somewhat poorly drained and moderately permeable. Although the water-holding capacity is very high, the amount of water available to all but salt and alkali-tolerant plants is somewhat limited. Fertility is high. Surface runoff is very slow, and there is little or no hazard of erosion.

Most of the acreage is used for grazing. A small part is cultivated and used for small grain, alfalfa, and grass. (Capability unit IVw–3; Alkali range site; not in a woodland group)

Freeman Series

The Freeman series consists of moderately well drained soils that have a surface layer of silt loam and a subsoil of heavy silt loam or light silty clay loam. These soils

occupy rolling to hilly uplands. They formed in layered loess under coniferous forest. The annual precipitation is about 23 inches, and the frost-free season is about 125 days.

Freeman soils are used for grain, peas, clover, alfalfa, and grass, and as woodland.

Freeman silt loam, 5 to 20 percent slopes (FaB).—This is the dominant soil on the silty upland north and east of Rockford. Most slopes are between 8 and 15 percent; a few small areas have slopes of more than 30 percent, and some of less than 5 percent. Slopes of more than 20 percent are short and are along the edges of the drainageways. Representative profile:

0 to 7 inches, very dark grayish-brown, friable silt loam; granular structure; neutral.
7 to 17 inches, brown, friable silt loam, grayish brown at a depth of 12 inches; neutral.
17 to 22 inches, grayish-brown, firm silt loam that breaks into 1- to 2-inch prisms; neutral.
22 to 72 inches, dark-brown, firm silty clay loam, almost silt loam; breaks into prisms 1 to 2 inches wide, and then into angular blocks ½ inch to 1 inch wide; neutral.

The surface soil, when moist, ranges from very dark grayish brown to dark brown in color. The texture of the subsoil ranges from heavy silt loam to silty clay loam. As much as 7 percent of some areas consists of Larkin, Dearyton, or severely eroded Freeman soils.

This is a moderately well drained soil that has a very slowly permeable subsoil and is saturated for short periods in spring. It holds about 5 to 7 inches of water that plants can use. It is easy to work except when saturated. Roots penetrate the lower layers mainly along ped faces. The fertility is medium. Surface runoff is medium, and the hazard of erosion is moderate.

More than 95 percent of the acreage is cultivated; the rest is farm woodlots. Wheat is the chief cash crop. It is grown in rotation with peas and a green-manure crop or in a wheat-fallow rotation. Other crops grown are peas and barley; clover or alfalfa for hay or green manure; and grass for seed, hay, or pasture. All grain and grass crops respond to nitrogen. Legumes respond to sulfur. (Capability unit IIIe–3; woodland group 5; not in a range site)

Freeman silt loam, 5 to 20 percent slopes, severely eroded (FaB3).—More than 50 percent of the surface layer of this soil has been removed by erosion. Fertility is medium to low. Surface runoff is rapid, and the hazard of erosion is severe. As much as 10 percent of some areas consists of uneroded Freeman soils.

The same crops are grown as on Freeman silt loam, 5 to 20 percent slopes, but yields are lower. (Capability unit IVe–3; woodland group 5; not in a range site)

Freeman silt loam, 20 to 30 percent slopes, severely eroded (FaC3).—More than 50 percent of the surface layer of this soil has been removed by erosion. Surface runoff is rapid, and the erosion hazard is severe. Included in mapping were a few areas of Dearyton soils.

The same crops are grown as on Freeman silt loam, 5 to 20 percent slopes, but yields are lower. (Capability unit IVe–3; woodland group 5; not in range site)

Fresh Water Marsh

Fresh water marsh (Fm) consists of shallow, swampy ponds and of fringes around lakes that have a fluctuating water level. The vegetation consists of tules, reeds, and rushes. These areas are of little value for grazing, but they are excellent places for hunting migratory waterfowl. (Capability unit VIIIw–1; not in a woodland group or range site)

Garfield Series

The Garfield series consists of well-drained, severely eroded soils that formed in loess under grass and small shrubs. These soils occupy ridgetops, knobs, and the upper slopes on rolling to hilly uplands. They have a surface layer of silty clay loam and a subsoil of silty clay that is very hard, sticky, and plastic. The annual precipitation is 18 to 22 inches, and the frost-free season is about 140 days.

These soils are used mainly for grain, alfalfa, and grass.

Garfield silty clay loam, 0 to 30 percent slopes, severely eroded (GaC3).—This soil occupies the narrow ridgetops and upper slopes on loessal uplands in the southeastern part of the county. Most slopes are between 8 and 20 percent; a few small areas have slopes of more than 30 percent, and some narrow ridgetops have slopes of less than 5 percent. Representative profile:

0 to 8 inches, dark-brown, firm silty clay loam; granular structure; neutral.
8 to 48 inches, dark-brown, firm silty clay, yellowish-brown silty clay loam below a depth of 23 inches; breaks into prisms 1 inch to 2 inches wide and then into angular blocks ¼ to ½ inch thick; clay films coat the prisms and angular blocks; neutral.
48 to 60 inches +, yellowish-brown, firm heavy silt loam; breaks into prisms 1 to 2 inches wide and then into angular blocks ¼ to ¾ inch thick; neutral.

The texture of the upper subsoil is silty clay or clay. As much as 10 percent of some areas consists of Athena, Naff, Nez Perce, or Palouse soils.

This soil is well drained and slowly permeable. It holds 9 or 10 inches of water that plants can use. It is sticky and plastic when wet; consequently, it can be cultivated only within a rather narrow range of moisture content. Root penetration is very deep. The fertility is medium. Surface runoff is rapid, and the hazard of further erosion is severe.

More than 95 percent of the acreage is cultivated; the rest is seeded to alfalfa or grass. Wheat is the chief crop. Other crops grown are barley and dry field peas. All crops respond to nitrogen, sulfur, and phosphorus. (Capability unit IVe–3; not in a woodland group or range site)

Garrison Series

The Garrison series is made up of somewhat excessively drained, gravelly or stony soils that formed under grass in glacial outwash mixed in the upper part with volcanic ash. These soils are on nearly level to moderately steep terraces. The annual precipitation is 18 to 22 inches, and the frost-free season is about 170 days.

Soils of the Garrison series are used for a variety of crops and as farmsteads and suburban lots.

Garrison gravelly loam, 0 to 5 percent slopes (GgA).—This is the dominant soil in the Spokane Valley east of the city of Spokane. Most slopes are between 2 and 5 percent. Representative profile:

0 to 15 inches, black, very friable gravelly loam; granular structure; slightly acid.
15 to 44 inches, dark-brown, friable very gravelly loam; neutral.
44 to 60 inches +, multicolored sand, gravel, and cobblestones.

The surface color, when moist, ranges from very dark brown to black. The texture of the surface layer is gravelly or very gravelly loam or silt loam. The subsoil ranges in color from dark brown to yellowish brown. Clay and lime have accumulated on the bottom of the pebbles in the lower subsoil. The depth to the gravel substratum ranges from 30 to 55 inches. As much as 10 percent of some areas consists of Bong or Phoebe soils or of other Garrison soils.

This soil is somewhat excessively drained and has moderately rapid permeability. It holds about 5 inches of water that plants can use. It is easy to work. Roots penetrate to the layer of sand, gravel, and cobblestones. The fertility is medium. Surface runoff is slow, and the hazard of erosion is slight.

About 80 percent of the acreage is cultivated; the rest is used for grazing, and as farmsteads or suburban lots. Most of the acreage is irrigated. Irrigated areas are used for orchard fruits and berries; cabbage, corn, cantaloup, cucumbers, celery, and squash; wheat, oats, and barley; alfalfa for hay; and grass for seed and pasture. Dryland areas are used for wheat, barley, and native bunchgrass. There is no difficulty in the use of machinery, but the gravel is hard on tillage implements. All crops except legumes respond to nitrogen. Some crops respond to sulfur, boron, and phosphorus. (Capability unit IIIs-2; Loamy range site; not in a woodland group)

Garrison gravelly loam, 5 to 20 percent slopes (GgB).—This soil has a surface layer 3 to 5 inches thinner than that of Garrison gravelly loam, 0 to 5 percent slopes. Runoff is medium, and the erosion hazard is moderate.

This soil is used in much the same way as Garrison gravelly loam, 0 to 5 percent slopes. (Capability unit IVe-5; Loamy range site; not in a woodland group)

Garrison very gravelly loam, 0 to 8 percent slopes (GmB).—This soil has a thinner, more gravelly surface layer than Garrison gravelly loam, 0 to 5 percent slopes, and holds less than 5 inches of water that plants can use. The gravel causes extreme wear on tillage machinery. As much as 7 percent of some areas consists of other Garrison soils. (Capability unit IVe-5; Shallow range site; not in a woodland group)

Garrison very stony loam, 0 to 20 percent slopes (GnB).—This soil holds less than 5 inches of water that plants can use, and it is too stony to be cultivated. As much as 15 percent of some areas consists of other Garrison soils, and as much as 2 percent is made up of granite outcrops.

This soil is used for grazing. (Capability unit VIs-2; Shallow range site; not in a woodland group)

Glenrose Series

The Glenrose series consists of well-drained, mostly medium-textured soils. These soils formed under grass and scattered pine trees in glacial till mixed in the upper part with loess and volcanic ash. Many areas are gravelly or stony. These soils are nearly level to very steep. The annual precipitation is about 21 inches, and the frost-free season is about 135 days.

Glenrose soils are used for grain, peas, lentils, vegetables, alfalfa, and grass, and for grazing.

Glenrose silt loam, 5 to 20 percent slopes (GpB).—This soil occurs on glaciated uplands in the east-central part of the county. Most slopes are between 6 and 15 percent. Representative profile:

0 to 13 inches, black, very friable silt loam; granular structure; neutral.
13 to 62 inches, dark-brown, firm loam that breaks into prisms 1 to 2 inches wide; slightly acid.
62 to 72 +, dark-brown, friable loam; slightly acid.

In places the surface layer is very dark brown. It is 10 to 16 inches thick. The texture of the subsoil ranges from silt loam to light silty clay loam. From 5 to 25 percent of the lower subsoil is composed of gravel and stones. As much as 5 percent of some areas consists of Bernhill, Dearyton, or Larkin soils.

This soil is well drained and moderately permeable. It holds 9 to 11 inches of water that plants can use. It is easy to work. Root penetration is very deep. The fertility is high. Surface runoff is medium, and the hazard of erosion is moderate.

More than 90 percent of the acreage is cultivated; the rest is grazed. Wheat is the chief crop. It is grown in rotation with barley, oats, peas, lentils, alfalfa, or grass. All grass and grain crops respond to nitrogen; legumes respond to sulfur. (Capability unit IIIe-2; Loamy range site; not in a woodland group)

Glenrose silt loam, 0 to 5 percent slopes (GpA).—This soil has a surface layer 2 to 4 inches thicker than that of Glenrose silt loam, 5 to 20 percent slopes. Surface runoff is slow, and the erosion hazard is slight. Included in mapping were small areas of Uhlig and Dearyton soils.

The same crops are grown as on Glenrose silt loam, 5 to 20 percent slopes; in addition, vegetables are grown. (Capability unit IIe-2; Loamy range site; not in a woodland group)

Glenrose silt loam, 20 to 30 percent slopes (GpC).—This soil has a surface layer 3 to 5 inches thinner than that of Glenrose silt loam, 5 to 20 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. About 5 percent of some areas consists of Bernhill and Dearyton soils.

The same crops are grown as on Glenrose silt loam, 5 to 20 percent slopes, but more of the acreage is in grass and legumes. (Capability unit IIIe-2; Loamy range site; not in a woodland group)

Glenrose silt loam, 30 to 55 percent slopes (GpD).—This soil has a surface layer 3 to 5 inches thinner than that of Glenrose silt loam, 5 to 20 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. About 3 percent of some areas consists of Bernhill or Dearyton soils. This soil is used only for grazing. (Capability unit VIe-1; North Exposure range site; not in a woodland group)

Glenrose gravelly silt loam, 5 to 20 percent slopes (GrB).—This soil holds from 7 to 9 inches of water that plants can use. Small areas of Bernhill and Dearyton soils were included in mapping.

This soil is used in much the same way as Glenrose silt loam, 5 to 20 percent slopes, but yields are less. (Capability unit IVe-4; Loamy range site; not in a woodland group)

Glenrose gravelly silt loam, 20 to 55 percent slopes (GrD).—This soil holds 7 to 9 inches of water that plants can use. Surface runoff is rapid, and the erosion hazard is severe. Included in mapping were areas of Bernhill silt loam, 30 to 55 percent slopes.

This soil is used for grazing. (Capability unit VIe–1; North Exposure range site; not in a woodland group)

Glenrose stony silt loam, 20 to 55 percent slopes (GsD).—More than 20 percent of the surface layer of this soil consists of stones. Surface runoff is medium, and the erosion hazard is severe. This soil holds 7 to 9 inches of water that plants can use. Included in mapping were a few areas that are gravelly rather than stony. This soil is used for grazing. (Capability unit VIs–2; North Exposure range site; not in a woodland group)

Green Bluff Series

In the Green Bluff series are moderately well drained, medium-textured soils. These soils formed under conifers in glacial till mixed in the upper part with loess and volcanic ash. They are nearly level to moderately steep. The subsoil is mottled and in most places is gravelly, cobbly, or stony. The annual precipitation is about 21 inches, and the frost-free season is about 135 days.

Green Bluff soils are used for grain, grass, peas, lentils, and truck crops and for apple orchards. They are also used for grazing and as woodland.

Green Bluff silt loam, 0 to 5 percent slopes (GtA).—This is the dominant soil that formed under forest on the basalt plateaus near Green Bluff. Representative profile:

0 to 7 inches, very dark grayish-brown, very friable silt loam; granular structure; slightly acid.
7 to 33 inches, brown, friable silt loam mottled with dark brown; slightly acid.
33 to 52 inches, brown, very friable very fine sandy loam mottled with dark brown; slightly acid; gravelly below a depth of 40 inches.
52 to 62 inches +, olive-brown, firm gravelly silt loam mottled with dark brown; slightly acid.

The color of the surface layer ranges from very dark grayish brown to dark brown. The texture of the subsoil ranges from silt loam to very fine sandy loam. The gravel content of the subsoil ranges from 10 to 30 percent. The gravel is a mixture of basalt, granite, gneiss, schist, and quartzite. Mottling in the subsoil is faint to distinct. The relief is nearly level to rolling. Laminated lacustrine beds occur in places at a depth of less than 60 inches. As much as 10 percent of some areas consists of Dearyton, Bernhill, and Uhlig soils.

This soil is moderately well drained and has moderate permeability. It holds about 10 inches of water that plants can use. It is easy to work. Root penetration is very deep. The fertility is medium. Surface runoff is slow, and the hazard of erosion is slight.

About 90 percent of this soil is cultivated; the rest is grazed or used as woodland. The main crops are wheat, oats, barley, grass seed, truck crops, and apples. All crops respond to nitrogen; legumes respond to sulfur.

Douglas-fir, ponderosa pine, and lodgepole pine are suited to this soil. (Capability unit IIe–2; woodland group 3; not in a range site)

Green Bluff silt loam, 5 to 20 percent slopes (GtB).—This soil has a surface layer 2 to 4 inches thinner than that of Green Bluff silt loam, 0 to 5 percent slopes. Surface runoff is medium, and the erosion hazard is moderate. Small areas of Bernhill, Clayton, and Uhlig soils were included in mapping.

The same crops are grown as on Green Bluff silt loam, 0 to 5 percent slopes. (Capability unit IIIe–2; woodland group 3; not in a range site)

Hagen Series

The Hagen series consists of somewhat excessively drained sandy loams and loamy fine sands underlain by sand below a depth of 30 inches. These soils are nearly level to moderately steep, and their topography is generally dunelike. They formed in glaciofluvial deposits derived from granitic rocks and volcanic ash, under conifers and shrubs. The annual precipitation is about 22 inches, and the frost-free season is about 120 days.

Hagen soils are used as woodland and for grain, alfalfa, and grass.

Hagen sandy loam, 0 to 20 percent slopes (HgB).—This is the dominant soil in the sandy areas in the northern part of Spokane County. Most slopes are between 2 and 8 percent. Representative profile:

0 to 11 inches, dark-brown, friable sandy loam; granular structure in the upper 4 inches; slightly acid or neutral. Undisturbed areas have an organic mat 1 inch thick on the surface.
11 to 24 inches, brown, very friable loamy fine sand; slightly acid.
24 to 38 inches, olive-brown, loose loamy sand in which there are two wavy bands of dark-brown loam 1/8 to 1/4 inch thick; neutral.
38 to 120 inches, variegated, medium-textured sand.

In places, a bleached layer, not more than 1/4 inch thick, is immediately below the surface layer. The thin, discontinuous bands in the lower subsoil have a loam texture in some places and in others are distinguishable only by a contrasting dark-brown color. As much as 10 percent of some areas consists of Bonner, Clayton, or Hagen loamy fine sands.

This soil is somewhat excessively drained and has rapid permeability. It holds 5 to 7 inches of water that plants can use. It is easy to work. Most roots penetrate only to the sand. The fertility is low. Surface runoff is slow. The hazard of wind erosion is moderate.

This soil is used mainly as woodland; less than 25 percent is cultivated. The principal crops are small grain, alfalfa, and grass. Small grain and grass respond to nitrogen, and nitrogen is desirable for establishing alfalfa. Alfalfa responds to sulfur and boron. (Capability unit IVe–6; woodland group 9; not in a range site)

Hagen loamy fine sand, 0 to 30 percent slopes (HfC).—This soil has a dunelike topography in most places. It is suited to ponderosa pine and lodgepole pine. It is not suited to cultivation; nevertheless, some areas have been seeded to alfalfa and grass for pasture and hay. Yields are low. (Capability unit VIs–1; woodland group 11; not in a range site)

Hardesty Series

The Hardesty series consists of moderately well drained, medium-textured soils mottled below a depth of about 20 inches. These soils are in slight depressions and nearly level areas along drainageways. They formed in volcanic ash under conifers, shrubs, and grass. The annual precipitation is 18 to 25 inches, and the frost-free season is about 110 days.

Hardesty soils are used for grain, alfalfa, and grass, for grazing, and as woodland.

Hardesty silt loam, 0 to 5 percent slopes (HhA).—This soil occurs throughout Spokane County, generally in small depressions. Most slopes are between 2 and 5 percent. Representative profile:

0 to 4 inches, very dark grayish-brown, friable silt loam; granular structure; slightly acid.
4 to 11 inches, dark-brown, very friable silt loam; slightly acid.
11 to 32 inches, brown, friable light silt loam mottled with dark brown; neutral.
32 to 60 inches +, yellowish-brown, friable very fine sandy loam mottled with dark brown; neutral; underlain by pale-brown, friable loamy fine sand below a depth of 39 inches; laminated with thin, wavy bands of dark-brown loam; neutral.

The surface layer ranges from very dark brown to dark grayish brown. The texture of the subsoil ranges from very fine sandy loam to silt loam. In the subsoil the mottles range from few and faint to common and distinct. As much as 5 percent of some areas consists of Cocolalla, Cheney, Uhlig, or moderately shallow Hardesty soils.

This soil is moderately well drained and has moderate permeability. It holds 7 to 9 inches of water that plants can use. It is easy to work. Root penetration is very deep. The fertility is low. Surface runoff is very slow, and there is little or no hazard of erosion.

About 25 percent of the acreage is cultivated; the rest is woodland or grassland. The cultivated areas are used for wheat, oats, barley, alfalfa, and grass. All crops except legumes respond to nitrogen; legumes respond to sulfur and phosphorus. (Capability unit IIIs–1; woodland group 10; not in a range site)

Hardesty silt loam, moderately shallow, 0 to 5 percent slopes (HmA).—This soil is underlain by gravel, coarse sand, or bedrock at a depth of 20 to 36 inches. As a consequence it holds only about 4 to 6 inches of water that plants can use. Included in mapping were small areas of Cocolalla, Cheney, Uhlig, and deep Hardesty soils.

Most of this soil is used for native or improved pasture. All crops except legumes respond to nitrogen. Legumes respond to sulfur and phosphorus. (Capability unit IIIs–1; woodland group 10; not in range site)

Hesseltine Series

The Hesseltine series consists of well-drained, medium-textured soils underlain by sand, gravel, and cobblestones at a depth of 12 to 36 inches. Many areas are gravelly or stony throughout, and some are underlain by bedrock below a depth of 20 inches. These soils occupy nearly level to very steep areas in the channeled scablands. They formed in glacial outwash mixed in the upper part with loess and volcanic ash, under ponderosa pine and grass. The annual precipitation is 17 to 20 inches, and the frost-free season is about 125 days.

Hesseltine soils are used for grain, alfalfa, and grass, for grazing, and as woodland.

Hesseltine silt loam, 0 to 10 percent slopes (HnB).—This soil is extensive in the channeled scablands. Most slopes are between 4 and 8 percent. Representative profile:

0 to 6 inches, dark-brown, friable silt loam; granular structure in upper 3 inches; slightly acid or neutral.
6 to 17 inches, dark-brown, firm silt loam, gravelly below a depth of 13 inches; breaks into ¼-inch to ½-inch subangular blocks; neutral.
17 to 36 inches, multicolored very gravelly, cobbly, and stony coarse sandy loam; loose; neutral.
36 to 60 inches +, gravel, cobblestones, and stones; nearly free of finer material.

The surface color ranges from very dark grayish brown to dark brown. In some places from 2 to 10 percent of the surface layer consists of waterworn gravel. The texture of the subsoil ranges from very gravelly loam to gravelly silt loam. The depth to the gravelly and cobbly layer ranges from 12 to 20 inches. Bedrock is present in places below a depth of 20 inches. As much as 10 percent of some areas consists of Cheney, Uhlig, Phoebe, Bong, or gravelly Hesseltine soils.

This soil is well drained and moderately permeable. It holds less than 5 inches of water that plants can use. It is easy to work. The roots of most plants penetrate only a few inches into the layer of gravel, cobblestones, and stones. The fertility is medium. Surface runoff is slow, and the hazard of erosion is slight.

About 35 percent of the acreage is cultivated; the rest is used for grazing and as woodland. Small grain and alfalfa are the chief crops. Legumes and grass for green manure are sometimes included in the crop rotation. This soil should be tilled early in spring while it is still moist, because it hardens when dry. Grass and grain crops respond to nitrogen, and legumes respond to sulfur. Ponderosa pine is the chief forest species. (Capability unit IVe–5; woodland group 16; not in a range site)

Hesseltine silt loam, moderately deep, 0 to 8 percent slopes (HoB).—This soil has a surface layer 2 to 3 inches thicker than that of Hesseltine silt loam, 0 to 10 percent slopes, and it is 20 to 36 inches deep over the cobbly layer. It holds 5 to 7 inches of water that plants can use. About 10 to 15 percent of some areas consists of Cheney, Uhlig, Bong, Phoebe, or gravelly Hesseltine soils.

About 80 percent of the acreage is cultivated; the rest is pasture or woodland. Small grain, alfalfa, and grass are the chief crops. Because of its greater effective depth, this soil has more alternative uses than Hesseltine silt loam, 0 to 10 percent slopes, and yields are higher. Grass and grain crops respond to nitrogen. Legumes respond to sulfur. (Capability unit IIIe–6; woodland group 16; not in a range site)

Hesseltine gravelly silt loam, 0 to 10 percent slopes (HrB).—The gravelly surface layer of this soil hinders cultivation to some extent. As much as 10 percent of some areas consists of Cheney, Uhlig, Bong, Phoebe, or stony Hesseltine soils.

About 35 percent of the acreage is cultivated; the rest is pasture or woodland. Small grain and alfalfa are the chief crops. (Capability unit IVe–5; woodland group 16; not in a range site)

Hesseltine stony silt loam, 0 to 20 percent slopes (HsB).—This soil is too stony to be tilled with machinery. About 10 percent of some areas consists of basalt rock outcrops or of Hesseltine gravelly loam that has a slope range of 0 to 10 percent.

This soil is used for grazing and for growing ponderosa pine (fig. 3). A few small areas are seeded to alfalfa and grass for pasture. (Capability unit VIs–1; woodland group 16; not in a range site)

Figure 3.—**Thinning and pruning ponderous pine on Hesseltine stony silt loam, 0 to 20 percent slopes.**

Hesseltine stony silt loam, mounded, 0 to 8 percent slopes (HtB).—From 20 to 50 percent of this mapping unit consists of mounds, or "biscuits," of moderately deep Hesseltine silt loam. The mounds are surrounded by Hesseltine stony silt loam, which makes up 50 to 80 percent of the mapping unit. The mounds are 15 to 60 feet in diameter and are from 2 to 5 feet in depth to basalt bedrock (fig. 4). These soils were mapped as a complex because they are so intermingled that is is not practical to show them separately on the map.

These soils are used for grazing and for the production of ponderosa pine. (Capability unit VIs–1; woodland group 16; not in a range site)

Hesseltine very rocky complex, 0 to 30 percent slopes (HvC).—From 25 to 50 percent of this mapping unit consists of basalt rock outcrops and unnamed very stony, very shallow soils. Most of the rest is Hesseltine silt loam that has a slope range of 0 to 10 percent. Steeper areas of Hesseltine soils and a few small areas of the poorly drained Cocolalla soils were included in mapping.

This complex is used for grazing and for the production of ponderosa pine. (As a complex: capability unit VIIs–2. By components: Hesseltine soil—capability unit IVe–5; woodland group 16; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Hesseltine very rocky complex, 30 to 55 percent slopes (HvD).—From 25 to 50 percent of this mapping unit consists of basalt rock outcrops and unnamed very shallow, very stony soils. The rest is Hesseltine silt loam that has a slope range of 30 to 55 percent. The acreage is used for growing ponderosa pine and for grazing. (As a complex: capability unit VIIs–2; Hesseltine soil—capability unit VIe–2; woodland group 16; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Hesseltine extremely rocky complex, 0 to 30 percent slopes (HxC).—From 50 to 80 percent of this mapping unit consists of basalt rock outcrops and unnamed very stony, very shallow soils. The rest is Hesseltine silt loam that

Figure 4.—**Hesseltine stony silt loam, mounded, 0 to 8 percent slopes The soil in the mounds is moderately deep Hesseltine silt loam; the soil surrounding the mounds is stony Hesseltine silt loam.**

has a slope range of 0 to 10 percent. Included in mapping were areas of steeper Hesseltine soils and a few small areas of poorly drained Cocolalla soils.

This complex is used for grazing and for growing ponderosa pine. (As a complex: capability unit VIIs–2. By components: Hesseltine soil—capability unit IVe–5; woodland group 16; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Konner Series

The Konner series consists of dark-colored, poorly drained and somewhat poorly drained, moderately fine textured soils that are mottled below a depth of 2 feet. These soils are on nearly level and gently sloping bottom lands. They formed in stratified alluvium under sedges, rushes, and grass. The alluvium contained some volcanic ash. The annual precipitation is about 21 inches, and the frost-free season is about 100 days.

Soils of the Konner series are used mainly for grain, clover, and grass and for grazing.

Konner silty clay loam (Kc).—This soil is along Deadman Creek and around the fringes of Saltese Flats and Newman Lake. In most areas it is nearly level, but in a few small areas it is gently sloping. Representative profile:

0 to 27 inches, black, friable silty clay loam above a depth of 11 inches; very dark grayish-brown, firm silty clay loam below 11 inches; soil breaks into prisms 1 to 2 inches wide; granular structure; neutral.

27 to 40 inches, very dark grayish-brown, firm clay loam that breaks into prisms ½ to 1 inch wide and then into ¼-inch to ½-inch angular blocks; dark-colored clay films occur on prisms and angular blocks; few faint mottles; neutral.

40 to 60 inches +, dark-brown, firm clay loam, almost sandy clay loam; few faint mottles; neutral.

The surface layer ranges from black to very dark gray in color and from silt loam to silty clay loam in texture. The subsoil ranges from silty clay loam to clay loam and may contain thin lenses of sand and gravel in the lower part. The mottling is faint to distinct. As much as 8 percent of some areas consists of Bridgeson silt loam or Semiahmoo muck.

This soil is poorly drained and slowly permeable. It holds 9 to 11 inches of water that plants can use and is high in fertility. It is difficult to work when wet, and cultivation is usually delayed in spring. Root penetration is limited by the excess water. Surface runoff is very slow or ponded. During spring runoff this soil is often flooded, and fresh material is deposited on the surface. There is little or no hazard of erosion.

This soil is used for hay, pasture, and small grain. All crops except legumes respond to nitrogen; legumes respond to sulfur. (Capability unit IVw–1; Wet Meadow range site; not in a woodland group)

Konner silty clay loam, drained (Kd).—As a result of artificial drainage or natural stream cutting, this soil is somewhat poorly drained rather than poorly drained. Wetness does not appreciably delay cultivation in spring. As much as 8 percent of some areas consists of Konner silty clay loam or Semiahmoo muck.

This soil is used for grass, clover, spring wheat, oats, and barley. Yields of grass, clover, and grain are high. All crops except legumes respond to nitrogen; legumes respond to sulfur. (Capability unit IIIw–2; not in a range site or woodland group)

Lakesol Series

The Lakesol series consists of well-drained, medium-textured soils that formed in loess overlying very old, laminated lake sediments of mixed mineralogy, including volcanic ash. These soils are nearly level to very steep. They formed under mixed conifers, shrubs, and grass. The annual precipitation is 19 to 23 inches, and the frost-free season is about 130 days.

These soils are used for grain, alfalfa, and grass. They are also used for grazing and as woodland.

Lakesol silt loam, 0 to 20 percent slopes (LaB).—This soil formed in loess over laminated lake sediments and is limited in extent. Representative profile:

0 to 9 inches, very dark grayish-brown, very friable silt loam; granular structure to a depth of 6 inches; neutral.

9 to 20 inches, brown, friable silt loam that, in places above a depth of 13 inches, breaks into blocks ½ to 1 inch wide, and below 13 inches, into laminations ¼ to ½ inch thick; neutral.

20 to 65 inches, light brownish-gray and reddish-yellow, firm coarse silt loam that breaks into laminations ¼ to ½ inch thick; neutral.

The color of the surface layer ranges from very dark brown to very dark grayish brown. The texture of the subsoil ranges from silt loam to heavy silt loam. A stone line may occur above the lake sediments, which are at a depth of 10 to 30 inches. As much as 5 percent of some areas consists of Bernhill or Dearyton soils.

This soil is well drained, has medium fertility, and is easy to work. It holds 9 to 11 inches of water that plants can use. The permeability of the laminated layer is moderately slow. Root penetration is very deep. Surface runoff is medium, and the hazard of erosion is moderate.

About 60 percent of the acreage is cultivated; the rest is seeded pasture or woodland. Small grain, alfalfa, and grass are the principal crops. All crops except legumes respond to nitrogen; legumes and sometimes wheat respond to sulfur. (Capability unit IIIe–1; woodland group 3; not in a range site)

Lakesol silt loam, 20 to 55 percent slopes (LaD).—This soil has a surface layer 2 to 3 inches thinner than that of Lakesol silt loam, 0 to 20 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. Small areas of Bernhill and Dearyton soils were included in mapping.

This soil is suitable for growing ponderosa pine and for grazing. (Capability unit VIe–2; woodland group 3; not in a range site)

Laketon Series

The Laketon series consists of moderately well drained, medium-textured soils that formed under conifers in volcanic ash and glaciofluvial sediments overlying stratified lacustrine deposits. These soils are nearly level to moderately steep. The annual precipitation is about 22 inches, and the frost-free season, about 100 days.

Laketon soils are used for grain, alfalfa, clover, and grass. They are also used for grazing and as woodland.

Laketon silt loam, 0 to 5 percent slopes (LeA).—This soil is in the extreme northwestern corner of the county, northwest of the town of Deer Park. Representative profile:

0 to 10 inches, dark grayish-brown, very friable silt loam; granular structure; neutral.

10 to 24 inches, brown, friable silt loam; few dark-brown mottles; neutral.

24 to 60 inches, brown firm silt loam mottled with dark brown; neutral. Slightly acid light silty clay loam below a depth of 32 inches.

The surface layer ranges from silt loam to very fine sandy loam, and the subsoil from very fine sandy loam to loam. The depth to the silty clay loam layer ranges from 32 to 60 inches. In some places there are dark-brown bands ⅛ inch to 2 inches thick in the profile. As much as 5 percent of some areas consists of Clayton loam.

This soil is moderately well drained and has moderately slow permeability. It holds 9 to 11 inches of water that plants can use. It has medium fertility and is easy to work. Root penetration is very deep. Surface runoff is slow, and the hazard of erosion is slight. Seeps are common on slopes along drainageways in the spring.

Approximately 75 percent of this soil is cultivated; the rest is used as woodland. Wheat, oats, barley, alfalfa, sweetclover, and grass are grown. All crops except legumes respond to nitrogen. Alfalfa and sweetclover respond to sulfur. Uncultivated areas of this soil are used for Douglas-fir, larch, ponderosa pine, and lodgepole pine. (Capability unit IIe–6; woodland group 3; not in a range site)

Laketon silt loam, 5 to 20 percent slopes (LeB).—Surface runoff is medium on this soil, and the erosion hazard is moderate. Small areas of Clayton loam were included in mapping.

The same crops are grown as on Laketon silt loam, 0 to 5 percent slopes. (Capability unit IIIe–5; woodland group 3; not in a range site)

Laketon fine sandy loam, 0 to 5 percent slopes (LfA).—Small areas of Clayton and other Laketon soils were included with this soil in mapping.

More than 80 percent of the acreage is cultivated; the rest is woodland. The same crops are grown as on Laketon silt loam, 0 to 5 percent slopes. (Capability unit IIe–6; woodland group 3; not in a range site)

Lance Series

The Lance series is made up of well-drained, medium-textured, calcareous soils that formed in layered loess containing volcanic ash, under grass. The soils are on knobs and narrow ridges and in steeply sloping areas. The annual precipitation is 16 to 20 inches. The frost-free season is about 140 days.

Lance soils are used for grain, alfalfa, and grass.

Lance silt loam, 0 to 30 percent slopes, severely eroded (LmC3).—This soil occurs on knobs, narrow ridges, and steep slopes on silty uplands in the western and southwestern parts of the county. Most slopes are between 10 and

25 percent. The more gentle slopes are on the narrow ridgetops. Representative profile:

0 to 9 inches, dark grayish-brown, friable silt loam; granular structure; moderately alkaline and strongly calcareous.
9 to 14 inches, white and brown, very firm silt loam that breaks into plates 1/8 to 3/8 inch thick; plates coated with lime; strongly alkaline and strongly calcareous.
14 to 22 inches, dark-brown, firm silt loam; strongly alkaline and strongly calcareous.
22 to 40 inches, dark-brown, firm silty clay loam that breaks into angular blocks 1/4 to 3/4 inch wide; strongly alkaline and strongly calcareous in seams.
40 to 60 inches, dark yellowish-brown, firm silt loam; moderately alkaline and slightly calcareous.

In some places as much as 15 percent of the surface layer consists of small, lime-silica cemented fragments. These areas may be very dark brown. The subsoil layers in some places contain thin plates strongly cemented with lime. As much as 5 percent of some areas consists of noncalcareous silty soils (Athena or Palouse soils). A large part of the acreage is only moderately eroded.

This soil is well drained and has moderately slow permeability. It holds about 5 to 7 inches of water that plants can use. It has low fertility. In general, it is easy to work. The strongly alkaline and strongly calcareous nature of the soil hinders root penetration, but some roots penetrate to a depth of 5 feet or more. Surface runoff is medium to rapid, and the erosion hazard is severe.

More than 90 percent of the acreage is cultivated; the rest is seeded to pasture. Wheat, barley, alfalfa, and grass are the main crops grown. Wheat is the chief cash crop. Alfalfa and grass are grown for hay, pasture, or green manure. Most areas are better suited to grass and legumes than to grain. Grain crops respond to nitrogen and phosphorus. Legumes respond to phosphorus and may also respond to boron. (Capability unit IVe–7; not in a woodland group or a range site)

Lance silt loam, 0 to 30 percent slopes (LmC).—The surface layer of this soil is 1 to 9 inches thicker than that of Lance silt loam, 0 to 30 percent slopes, severely eroded. Also, the surface layer is very dark brown or nearly black and is free of lime in the upper part. The same crops are grown as on the severely eroded soil, but yields are higher. (Capability unit IIIe–1; Loamy range site; not in a woodland group)

Larkin Series

The Larkin series consists of well-drained, nearly level to very steep soils of silt loam texture throughout. These soils formed in deep deposits of loess mixed with some volcanic ash, under ponderosa pine and grass. The annual precipitation is 22 to 25 inches, and the frost-free season is 100 to 130 days.

Soils of the Larkin series are used for grain, peas, lentils, alfalfa, and grass.

Larkin silt loam, 5 to 20 percent slopes, eroded (LnB2).—This is the dominant soil on the loessal uplands northwest of Fairfield. Most slopes are between 5 and 20 percent; in a few small areas slopes are less than 5 percent, and in some they are more than 25 percent. Slopes of more than 20 percent are short. The gently sloping areas are on ridgetops. Representative profile:

0 to 13 inches, very dark grayish-brown, very friable silt loam; granular above a depth of 8 inches; slightly acid to neutral.
13 to 24 inches, dark-brown, friable silt loam; neutral.
24 to 56 inches, dark-brown, firm heavy silt loam that breaks into prisms 1 to 2 inches wide below a depth of 40 inches; prisms break into angular blocks 1/2 to 1 inch wide; clay films on prisms and angular blocks; three thin, dark-brown, wavy bands occur in this layer; neutral.
56 to 72 inches, dark-brown, firm silt loam; neutral.

The color of the surface layer ranges from very dark grayish brown to dark brown, and the thickness from 8 to 14 inches. As much as 15 percent of some areas consists of Naff, Freeman, and Bernhill soils. Also included are small severely eroded spots.

This soil is well drained and moderately permeable. It holds 9 to 11 inches of water that plants can use. It has medium fertility and is easy to work. Root penetration is very deep. Surface runoff is medium, and the hazard of further erosion is moderate.

More than 90 percent of the acreage is cultivated; the rest is used as woodlots and farmsteads. Wheat is the chief cash crop. Other crops grown are peas, oats, lentils, barley, alfalfa, and grass (fig. 5). All crops except legumes respond to nitrogen; legumes respond to sulfur. (Capability unit IIIe–2; woodland group 5; not in a range site)

Larkin silt loam, 0 to 5 percent slopes, eroded (LnA2).—This soil has a surface layer 2 to 4 inches thicker than that of Larkin silt loam, 5 to 20 percent slopes, eroded. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. Included in mapping were small areas of Naff and Freeman soils and some severely eroded spots.

This soil has more alternative uses than Larkin silt loam, 5 to 20 percent slopes, eroded, and generally produces higher yields. (Capability unit IIe–3; woodland group 5; not in a range site)

Larkin silt loam, 20 to 45 percent slopes, eroded (LnD2).—This soil has a surface layer 2 to 4 inches thinner than that of Larkin silt loam, 5 to 20 percent slopes, eroded. Surface runoff is rapid, and the hazard of further erosion is severe. Using farm machinery on this steep soil is difficult. Areas of Naff and Bernhill soils were included in mapping.

This soil has fewer alternative uses than Larkin silt loam, 5 to 20 percent slopes, eroded. Except for lentils and peas, the same crops are grown. Yields are less, however, and alfalfa and grass are grown for a longer time in the rotation. (Capability unit IVe–2; woodland group 5; not in a range site)

Latah Series

The Latah series consists of dark-colored, poorly drained and somewhat poorly drained soils that formed in alluvium mixed with volcanic ash, under grass, sedges, and shrubs. These soils have a very hard, mottled subsoil of silty clay. They occupy level and nearly level bottom lands and low terraces. The annual precipitation is about 22 inches, and the frost-free season is about 110 days.

Latah soils are used for spring grain, clover, and grass.

Latah silt loam (Lt).—This soil is on bottoms and low terraces and along drainageways in the southeastern part of the county. Most slopes are nearly level or gently sloping. Low areas are subject to occasional overflow. Representative profile:

0 to 8 inches, black, friable silt loam that breaks into plates 1/16 to 1/8 inch thick; slightly acid.

Figure 5.—**Bluegrass swathed before a harvest of seed on Larkin silt loam, 5 to 20 percent slopes, eroded. Grass will be plowed under after 7 to 10 years.**

8 to 32 inches, black, firm silty clay loam, very dark gray below a depth of 23 inches; soil breaks into prisms 1 inch to 2 inches wide and then into angular blocks ¼ to 1 inch wide; strong-brown mottles; slightly acid.
32 to 38 inches, dark-gray, very friable heavy silt loam; neutral.
38 to 60 inches +, very dark gray, firm silty clay; soil breaks into prisms 1 inch to 2 inches wide; strong-brown mottles; clay films on prisms; neutral.

The surface layer ranges from very dark gray to black in color and from silt loam to silty clay loam in texture. The subsoil is silty clay loam to silty clay. The profile is slightly acid to moderately alkaline. A few small areas of Caldwell silt loam were included in mapping.

This soil is somewhat poorly drained or poorly drained and very slowly permeable. It holds 9 to 11 inches of water that plants can use. It is high in fertility. It is easy to work, but tillage is sometimes delayed in spring by a temporary high water table. Freezes late in spring are common. Although restricted by excess water and the very slowly permeable subsoil, some roots penetrate below a depth of 5 feet. Surface runoff is slow, and the hazard of erosion is slight. Low areas are subject to overflow.

More than 90 percent of the acreage is cultivated; the rest is used as grassed waterways. Spring wheat is the chief crop. Other crops grown are barley, oats, clover, and grass. Grain crops respond to nitrogen; legumes respond to sulfur. (Capability unit IIIw–2; Bottomland range site; not in a woodland group)

Marble Series

The Marble series is made up of excessively drained soils that have a surface layer of loamy sand, loamy coarse sand, or sandy loam and a subsoil or substratum of coarse sand. These soils occupy level to moderately steep terraces. They formed in sandy outwash under grass, shrubs, and scattered pines. The annual precipitation is 15 to 20 inches, and the frost-free season is about 140 days.

Marble soils are used for grass and alfalfa, as woodland, and as building sites.

Marble loamy sand, 0 to 30 percent slopes (MaC).—This is the dominant soil on the sandy, somewhat dunelike terraces near Deep Creek and the town of Chester. Most slopes are between 4 and 12 percent. Representative profile:

0 to 3 inches, very dark brown, very friable loamy sand; granular structure; slightly acid.
3 to 6 inches, dark-brown, very friable loamy coarse sand; slightly acid.
6 to 60 inches +, light olive-brown, loose coarse sand; multicolored below a depth of 47 inches; few, irregular, wavy bands of loam ⅛ to ¼ inch thick at a depth between 6 and 47 inches; neutral.

The color of the surface layer ranges from very dark grayish brown to very dark brown. As much as 5 percent of some areas consists of Springdale or other Marble soils.

This soil is excessively drained and rapidly permeable. It holds less than 5 inches of water that plants can use and is low in fertility. It is easy to work. Root penetration is very deep. Surface runoff is slow. There is a slight hazard of water erosion and a severe hazard of wind erosion.

This soil is suited to grazing and to growing ponderosa pine. It is not generally considered suitable for cultivation; however, fair stands of alfalfa are obtained a few years after establishment. (Capability unit VIIs–1; woodland group 17; not in a range site)

Marble sandy loam, 0 to 8 percent slopes (McB).—This soil occurs on terraces in the central part of the county. Representative profile:

0 to 8 inches, dark grayish-brown, very friable sandy loam; granular structure; neutral; undisturbed areas have an organic mat 1 inch thick on the surface.
8 to 23 inches, light yellowish-brown, very friable fine sandy loam underlain by friable coarse sandy loam below a depth of 16 inches; slightly acid.
23 to 60 inches, variegated coarse sand; loose; neutral.

The color of the uppermost 8 inches ranges from very dark grayish brown to dark brown. The texture of the subsoil ranges from fine sandy loam to coarse sandy loam. The depth to coarse sand ranges from 20 to 48 inches. In some areas a few waterworn pebbles occur in the soil. As much as 10 percent of some areas consists of Springdale, Marble, or Bong soils that have a slope range of 0 to 8 percent.

This soil is somewhat excessively drained and has moderately rapid permeability. It holds 5 inches or less of water that plants can use. It is low in fertility. It is easy to work. Root penetration is very deep. Surface runoff is slow, and there is little or no hazard of erosion.

About 10 percent of the acreage is cultivated; the rest is used for growing ponderosa pine, for grazing, and as homesites. The principal crops are wheat, alfalfa, grass, and legumes. Grass and grain crops respond to nitrogen, and nitrogen is also desirable for establishing legumes. This soil is very good for residential and other building sites. (Capability unit IVe–5; woodland group 15; not in a range site)

Marble loamy coarse sand, 0 to 30 percent slopes (MbC).—This is the dominant soil that formed from glacial sands reworked by wind. It is near Mead. Most slopes are between 7 and 15 percent; there are a few slopes of more than 15 percent, and a few of less than 7 percent. Representative profile:

0 to 5 inches, very dark brown loamy coarse sand; granular structure; slightly acid; undisturbed areas have a thin layer of pine needles and twigs on the surface.
5 to 13 inches, dark-brown loamy coarse sand; slightly acid.
13 to 24 inches, brown to dark-brown sand; neutral.
24 to 60 inches +, variegated but dominantly dark yellowish-brown sand; three yellowish-brown, wavy, irregular band-like stainings occur in this layer, and they are finer textured than the surrounding material; neutral.

The color of the surface layer ranges from very dark brown to very dark grayish brown, and the texture from loamy sand to sand. The texture of the subsoil ranges from loamy coarse sand to coarse sand. In places there are a few pebbles in the profile. A few granite outcrops occur in places. As much as 7 percent of some areas consists of Marble sandy loam, Marble loamy sand, or Hagen loamy fine sand.

This soil is excessively drained and rapidly permeable. It holds less than 5 inches of water that plants can use. It is low in fertility. It is easy to work. Root penetration is very deep. Surface runoff is slow, and the hazard of water erosion is slight, but there is a severe hazard of wind erosion.

Less than 20 percent of this soil is cultivated. Alfalfa and grass are the chief crops. Grain should be grown only when reestablishing alfalfa and grass. Yields of hay and pasture are fair, but yields of grain are low. Alfalfa needs phosphorus and minor elements. (Capability unit VIs–1; woodland group 14; not in a range site)

Mondovi Series

The Mondovi series consists of very deep, dark-colored, well-drained soils of silt loam texture throughout. These soils formed under grass in silty alluvium that included volcanic ash. They are in nearly level areas along drainageways. The annual precipitation is 15 to 18 inches. The frost-free season is about 110 days.

The Mondovi soils are used for grain, peas, alfalfa, clover, and grass.

Mondovi silt loam (Md).—This is the dominant soil along drainageways in the silty uplands in the western and southwestern parts of the county. The slope range is 0 to 5 percent. Representative profile:

0 to 60 inches, very dark brown, friable silt loam; granular structure in upper 8 inches; neutral.

In places the surface layer is black. As much as 5 percent of some areas consists of Athena, Reardan, or Uhlig soils.

This soil is well drained and moderately permeable. It holds more than 11 inches of water that plants can use. It is high in fertility. Root penetration is very deep. Surface runoff is slow, and the hazard of erosion is slight. This soil may be saturated for a few days in spring, and some areas are flooded occasionally.

More than 95 percent of the acreage is cultivated; the rest is used for seeded pasture and waterways. Wheat is the chief cash crop. In most places it is grown in a wheat-fallow rotation, but some areas are cropped annually and peas, barley, and oats are included in the rotation. Other crops grown are alfalfa for hay or green manure, and grass for pasture or hay. All crops except legumes respond to nitrogen. Some crops, especially legumes, respond to sulfur. (Capability unit IIe–5; Bottomland range site; not in a woodland group)

Moscow Series

The Moscow series consists of well-drained, medium-textured soils underlain by bedrock at a depth of 20 to 30 inches or more. These soils formed under conifers in weathered granite, gneiss, or schist that is mixed in the upper part with loess and volcanic ash. They are on hilly to steep uplands. The annual precipitation is 20 to 27 inches, and the frost-free season is about 90 days.

Moscow soils are used for grain, alfalfa, and grass and as woodland.

Moscow silt loam, 30 to 55 percent slopes (MmD).—This is the dominant soil on the mountainous uplands in

the northeastern part of the county. Most slopes are between 35 and 45 percent; in a few small areas the slopes are more than 55 percent, and some are less than 30 percent. The steeper slopes are those that face north and east. Representative profile:

1 inch to 0, fir needles, twigs, and leaves.
0 to ½ inch, grayish-brown, very friable very fine sandy loam; medium acid.
½ inch to 13 inches, dark-brown, very friable silt loam, almost loam; medium acid.
13 to 27 inches, yellowish-brown, friable loam; about 10 percent gravel; strongly acid. Variegated decomposing granite.

The depth to hard rock is more than 30 inches. The surface layer contains varying amounts of volcanic ash. The color of the subsoil may be yellowish brown, brown, or reddish brown. As much as 10 percent of some areas is Spokane loam.

This soil is well drained and has moderately rapid permeability. It holds 5 to 7 inches of water that plants can use. It is low in fertility. Machinery is difficult to use on the steep slopes. Roots penetrate to the decomposing granite and through fractures in it. Surface runoff is rapid, and the hazard of erosion is severe.

Most of this soil is used for timber. (Capability unit VIe–2; woodland group 2; not in a range site)

Moscow silt loam, 0 to 30 percent slopes (MmC).—Surface runoff is medium to rapid on this level to steep soil, and the hazard of erosion is moderate to severe. There is no limitation in the use of logging or farm machinery. A few areas of Spokane soils and steeper Moscow soils were included in mapping.

This soil has more alternative uses than Moscow silt loam, 30 to 55 percent slopes. Small areas are cleared and seeded to alfalfa and grass or small grain. Grass and grain crops respond to nitrogen. Legumes respond to sulfur, boron, and phosphorus. (Capability unit IVe–4; woodland group 2; not in a range site)

Moscow silt loam, shallow, 0 to 30 percent slopes (MoC).—This soil is on southern and western slopes and is 20 to 30 inches deep to hard rock. It holds less than 5 inches of water that plants can use. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe. A few areas of Spokane soils and deep Moscow soils were included in mapping.

This soil is used mostly for timber and for limited grazing. Small areas are cultivated and used for small grain, grass, and alfalfa. (Capability unit VIe–2; woodland group 6; not in a range site)

Moscow silt loam, shallow, 30 to 55 percent slopes (MoD).—This soil is 20 to 30 inches deep to hard rock. It holds less than 5 inches of water that plants can use. Included in mapping were shallow Spokane soils and deeper Moscow soils.

This soil is used for timber and for limited grazing. (Capability unit VIe–2; woodland group 6; not in a range site)

Moscow very rocky complex, 0 to 30 percent slopes (MsC).—From 50 to 80 percent of this complex is shallow Moscow silt loam; the rest consists of granite rock outcrops and of very stony, very shallow soils. This complex is used for growing timber and for limited grazing. There is little difficulty in the use of logging equipment. (As a complex: capability unit VIIs–2. By components: Moscow soil—capability unit VIe–2; woodland group 6; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Moscow very rocky complex, 30 to 70 percent slopes (MsE).—From 20 to 50 percent of this complex consists of granite rock outcrops, and most of the rest is shallow Moscow silt loam that has a slope range of 30 to 55 percent. Some very stony and very shallow soils were included in mapping. Using logging equipment is difficult. This complex is used only for growing timber and for grazing. (As a complex: capability unit VIIs–2. By components: Moscow soil—capability unit VIe–2; woodland group 6; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Naff Series

The Naff series is made up of dark-colored, well-drained soils that formed in deep deposits of loess mixed with some volcanic ash, under grass and shrubs. These soils have a surface layer of silt loam and a subsoil of silty clay loam or silty clay. They are nearly level to steep and hilly soils on uplands. The annual precipitation is 18 to 22 inches. The frost-free season is about 140 days.

Soils of the Naff series are used for grain, peas, lentils, alfalfa, clover, and grass.

Naff silt loam, 5 to 30 percent slopes (NaC).—This is the dominant soil on the loessal uplands in the southeastern part of the county. Most slopes are between 7 and 25 percent; a few small areas have slopes of more than 30 percent, and some have slopes of less than 5 percent. Slopes of more than 25 percent are short. Representative profile:

0 to 17 inches, very dark brown, friable silt loam; granular structure; neutral, slightly acid below a depth of 8 inches.
17 to 26 inches, dark-brown, firm heavy silt loam that breaks into prisms ¼ to ½ inch wide; neutral.
26 to 61 inches, dark-brown, firm silty clay loam grading to brown below a depth of 61 inches; breaks into prisms 1 inch to 2 inches wide, and then into angular blocks ¼ to ½ inch thick; clay films on angular blocks; neutral.

The color of the surface layer ranges from very dark brown to black. The texture of the subsoil ranges from heavy silt loam to silty clay. This soil contains small amounts of volcanic ash. As much as 12 percent of some areas consists of Nez Perce, Palouse, and eroded Garfield soils.

This soil is well drained and has moderately slow permeability. It holds 9 to 11 inches of water that plants can use. It is high in fertility. Root penetration is very deep. Surface runoff is medium, and the hazard of erosion is moderate.

More than 95 percent of the acreage is cultivated. Winter wheat is the principal cash crop. Other crops grown are spring wheat, barley, oats, peas, lentils, alfalfa, grass, and clover. Grass is seeded for hay and pasture, and also to protect waterways. Using large, heavy farm machinery is difficult on the steeper slopes. All crops except legumes respond to nitrogen; legumes respond to sulfur. In some areas wheat also responds to sulfur. (Capability unit IIIe–2; not in a woodland group or range site)

Naff silt loam, 0 to 5 percent slopes (NaA).—This soil has a surface layer 3 to 5 inches thicker than that of Naff silt loam, 5 to 30 percent slopes. Surface runoff is slow

to medium, and the erosion hazard is slight to moderate. Using machinery is not difficult.

This soil has more alternative uses than Naff silt loam, 5 to 30 percent slopes, and produces slightly higher yields. (Capability unit IIe–3; not in a woodland group or a range site)

Naff silt loam, 0 to 5 percent slopes, eroded (NaA2).—From 30 to 50 percent of the original surface layer of this soil has been removed by erosion. The fertility is medium.

This soil has more alternative uses than Naff silt loam, 5 to 30 percent slopes. (Capability unit IIe–3; not in a woodland group or range site)

Naff silt loam, 5 to 30 percent slopes, eroded (NaC2).—This soil is slightly lighter colored than Naff silt loam, 5 to 30 percent slopes, and from 30 to 50 percent of the original surface layer has been removed by erosion. The fertility is medium. Severely eroded spots on the steeper slopes were included with this soil in mapping.

The same crops are grown as on Naff silt loam, 5 to 30 percent slopes. (Capability unit IIIe–2; not in a woodland group or range site)

Naff silt loam, 30 to 45 percent slopes, eroded (NaD2).—This soil is slightly lighter colored than Naff silt loam, 5 to 30 percent slopes, and from 30 to 50 percent of the original surface layer has been removed by erosion. Severely eroded spots were included in mapping. The fertility is medium. Surface runoff is rapid, and the hazard of further erosion is severe.

This soil is suited to grass and legumes and an occasional grain crop. (Capability unit IVe–2; not in a woodland group or range site)

Naff silt loam, 0 to 30 percent slopes, severely eroded (NaC3).—This soil has had more than 60 percent of the original surface layer removed by erosion. It is medium in fertility, and it holds 7 to 9 inches of water that plants can use. Surface runoff is rapid, and the hazard of further erosion is severe.

The same crops are grown as on Naff silt loam, 5 to 30 percent slopes. (Capability unit IVe–3; not in a woodland group or range site)

Narcisse Series

The Narcisse series consists of moderately well drained, medium-textured, nearly level soils along drainageways in the mountains and on foot slopes. These soils formed in micaceous alluvium under conifers and grass. The annual precipitation is 22 to 27 inches, and the frost-free season is about 90 days.

The Narcisse soils are used for grain, alfalfa, and grass. They are also used for grazing and as woodland.

Narcisse silt loam, 0 to 5 percent slopes (NcA).—This is the dominant soil along drainageways in the mountains and foot slopes. Representative profile:

- 0 to 14 inches, black, very friable silt loam, very dark brown below a depth of 8 inches; granular structure; neutral.
- 14 to 25 inches, brown, friable loam or silt loam; neutral.
- 25 to 34 inches, dark-brown, slightly mottled, very friable very fine sandy loam; neutral.
- 34 to 62 inches, dark-brown, slightly mottled, very friable fine sandy loam; sandy loam below a depth of 48 inches; neutral.

The surface layer ranges from black to very dark grayish brown. In some areas it is gravelly. Stratified lenses of sand and gravel are common in the subsoil. As much as 5 percent of some areas consists of Bridgeson or Peone soils.

This soil is moderately well drained and moderately permeable. It holds about 9 inches of water that plants can use. It is easy to work. The fertility is medium. Root penetration is very deep. Surface runoff is slow, and the hazard of erosion is slight. Some areas are subject to overflow and deposition of fresh material.

About 50 percent of the acreage is cultivated; the rest is used for grazing and for limited production of timber. Wheat, barley, oats, alfalfa, and grass are the main crops. All crops except legumes respond to nitrogen; legumes respond to phosphorus and sulfur. (Capability unit IIIw–1; woodland group 18; not in a range site)

Nez Perce Series

The Nez Perce series is made up of moderately well drained soils that have a surface layer of dark-colored silt loam and a finer textured subsoil that is predominantly silty clay. These soils formed in loess mixed with volcanic ash and possibly some glacial till, under grass. They are nearly level to moderately steep. The annual precipitation is about 21 inches, and the frost-free season is about 140 days.

Nez Perce soils are used for grass, grain, vegetables, and alfalfa and for orchards. They are also used for grazing and as farmsteads.

Nez Perce silt loam, 0 to 5 percent slopes (NpA).—This is the dominant soil in the depressions and nearly level areas on Pleasant and Orchard Prairies. It also occurs in the foothills and in the valley near Latah. Most slopes are between 0 and 3 percent; there are a few of as much as 6 percent. Representative profile:

- 0 to 18 inches, black, friable silt loam; granular structure; neutral.
- 18 to 27 inches, dark grayish-brown, very friable very fine sandy loam; neutral.
- 27 to 66 inches, dark-brown, very firm silty clay that breaks into columns that are 1 to 2 inches wide and have rounded tops; this layer is silty clay loam in the lower 20 inches and has strong, sharp-cornered, angular blocky structure; blocks are ¼ to ½ inch in diameter; neutral and mildly alkaline.
- 66 inches +, brown, firm light silty clay loam; laminated layers are 1/16 to ¼ inch thick; neutral.

The color of the surface layer ranges from black to very dark gray. The texture of the lower part of the surface layer ranges from silt loam to very fine sandy loam, and the texture of the subsoil ranges from silty clay loam to silty clay. In places the depth to bedrock is less than 60 inches. In some areas a few pebbles are present in the profile. Lime may be present in seams in the lower subsoil. Small areas of Naff, Palouse, and Uhlig soils were included in mapping.

This soil is moderately well drained and slowly permeable. It is saturated for a few weeks in the spring, and using machinery is somewhat difficult when the soil is wet. In places water ponds on the surface; in others, surface runoff is slow. This soil holds 5 to 7 inches of water that plants can use. It has medium fertility. Roots penetrate the subsoil mainly along ped surfaces. There is little or no hazard of erosion.

More than 90 percent of the acreage is cultivated; the rest is used for grazing and as farmsteads. The principal crops are grass seed, wheat, and vegetables. Other crops

are barley, oats, and alfalfa and grass for hay and pasture. All crops except legumes respond to nitrogen; legumes respond to sulfur and sometimes to boron. (Capability unit IIw–2; not in a woodland group or range site)

Nez Perce silt loam, 5 to 20 percent slopes (NpB).—This soil has a surface layer 2 to 4 inches thinner than that of Nez Perce silt loam, 0 to 5 percent slopes; also, the subsoil contains less clay and more gravel, and the soil is not saturated for as long a period in the spring. Surface runoff is medium, and the erosion hazard is moderate. There is little or no difficulty in the use of farm machinery except when the soil is saturated in the spring. As much as 5 percent of some areas consists of Bernhill, Dearyton, Naff, or Palouse soils, or of steeper Nez Perce soils.

This soil is used for grain, grass seed, and alfalfa and grass for pasture. It is also used for vegetables and orchards. (Capability unit IIIe–3; not in a woodland group or range site)

Nez Perce silt loam, 5 to 20 percent slopes, severely eroded (NpB3).—More than 50 percent of the original surface layer of this soil has been removed by erosion. Fertility is medium. Surface runoff is rapid, and the hazard of further erosion is severe. As much as 10 percent of some areas consists of Garfield, Naff, and uneroded Nez Perce soils.

The same crops are grown as on Nez Perce silt loam, 5 to 20 percent slopes, but grass and legumes are more common in the rotation. (Capability unit IVe–3; not in a woodland group or range site)

Palouse Series

In the Palouse series are dark-colored, well-drained soils that have a silt loam surface layer and a silt loam subsoil. Although more than 60 inches deep in most places, Palouse soils in Spokane County are underlain by bedrock at a depth of 20 inches in some places. These soils formed in loess mixed with volcanic ash, under grass. They occupy nearly level to very steep uplands. The annual precipitation is 18 to 22 inches, and the frost-free season is about 140 days.

Soils of the Palouse series are used for grain, peas, lentils, alfalfa, and grass and for grazing.

Palouse silt loam, moderately shallow, 0 to 20 percent slopes (PaB).—This soil occurs on loessal uplands in the southern part of the county. Most slopes are between 4 and 12 percent. A few are steeper than 20 percent. Representative profile:

0 to 13 inches, very dark brown, friable silt loam, very dark grayish brown below a depth of 9 inches; granular structure; neutral.

13 to 29 inches, dark-brown, friable silt loam, dark yellowish brown below a depth of 18 inches; breaks into prisms 1 to 2 inches wide and then into ½-inch to 1-inch subangular blocks; neutral.

29 inches +, basalt bedrock.

In places the surface layer is black. The depth to basalt ranges from 20 to 36 inches. A few basalt fragments occur on the surface and throughout the profile in places. As much as 5 percent of some areas consists of Naff soils or eroded Palouse soils.

This soil is well drained and moderately permeable. It holds 4 to 7 inches of water that plants can use. Fertility is medium. Roots penetrate to the bedrock. There is little difficulty in the use of farm machinery. Surface runoff is medium, and the hazard of erosion is moderate.

More than 90 percent of this soil is cultivated. Wheat is the chief crop. In most places it is grown in a wheat-pea rotation. Other crops grown are barley, alfalfa for hay or green manure, and grass for hay, pasture, or seed. Grass and grain crops respond to nitrogen, and some crops, especially legumes, respond to sulfur. (Capability unit IIIe–4; Shallow range site; not in a woodland group)

Palouse silt loam, moderately shallow, 20 to 30 percent slopes (PaC).—This soil has a surface layer 2 to 3 inches thinner than that of Palouse silt loam, moderately shallow, 0 to 20 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. Included in mapping were a few areas that have slopes of less than 20 percent.

More than 70 percent of this soil is cultivated. It has fewer uses than Palouse silt loam, moderately shallow, 0 to 20 percent slopes, and produces lower yields of most crops. (Capability unit IIIe–4; Shallow range site; not in a woodland group)

Palouse silt loam, 5 to 30 percent slopes, eroded (PbC2).—This soil is more than 60 inches deep to bedrock. Erosion has removed 6 to 12 inches of the original surface layer. This soil is high in fertility. It holds 9 to 11 inches of water that plants can use. Included in mapping were areas of moderately shallow Palouse soils and some severely eroded areas.

Almost all of this soil is cultivated. It is used in much the same way as Palouse silt loam, moderately shallow, 0 to 20 percent slopes, but produces higher yields. (Capability unit IIIe–2; not in a woodland group or range site)

Palouse very rocky complex, 0 to 30 percent slopes (PcC).—From 50 to 70 percent of this complex is moderately shallow Palouse silt loam. The rest consists of basalt rock outcrops and of unnamed very shallow soils. This complex is used only for grazing. (As a complex: capability unit VIs–2. By components: Palouse soil—capability unit IIIe–4; Shallow range site; not in a woodland group. Rock outcrops—capability unit VIIIs–1; not in a range site or woodland group)

Palouse very rocky complex, 30 to 70 percent slopes (PcE).—From 50 to 70 percent of this complex is moderately shallow Palouse silt loam. The rest consists of basalt rock outcrops and of unnamed very shallow soils 6 to 10 inches thick. This complex is used for grazing. (As a complex: capability unit VIIs–2. By components: Palouse soil—capability unit VIIe–1; south exposures in Shallow range site, north exposures in North Exposure range site; not in a woodland group. Rock outcrops—capability unit VIIIs–1; not in a range site or woodland group)

Peone Series

The Peone series consists of poorly drained silt loams underlain below a depth of 42 inches by strata ranging in texture from silt loam to loamy coarse sand. These soils formed in alluvium containing volcanic ash and diatomite, under water-tolerant grass and shrubs. They are nearly level to gently sloping and occur along drainageways and streams. Many areas are subject to flooding and deposition of fresh soil material. The annual precipitation is about 21 inches. The frost-free season is about 90 days.

Peone soils are used mainly for grain, clover, and grass and for grazing.

Peone silt loam, 0 to 5 percent slopes (PeA).—This soil is along Peone Creek and along intermittent streams on Peone Prairie. For the most part, this soil is nearly level; a few areas are gently sloping. Representative profile:

0 to 6 inches, very dark grayish-brown, friable silt loam; granular structure; neutral.
6 to 30 inches, dark-gray, friable silt loam mottled with dark brown; granular structure in the upper 4 inches; neutral.
30 to 60 inches +, grayish-brown, friable very fine sandy loam mottled with dark brown; slightly acid. Loamy coarse sand below a depth of 42 inches.

The color of the surface layer ranges from very dark grayish brown to black. The texture of the subsoil ranges from silt loam to very fine sandy loam. Layers of nearly pure pumicite 2 to 12 inches in thickness are characteristic in the subsoil. Gray and strong-brown mottles occur very near the surface in places. As much as 10 percent of some areas consists of Konner soils or other Peone soils.

This soil is poorly drained and moderately permeable. It holds 7 to 9 inches of water that plants can use. It is medium in fertility. It is easy to work, but tillage is often delayed by wetness in spring. Root penetration is deep. Surface runoff is very slow, and in places water ponds on the surface. Many areas are subject to flooding and to deposition of fresh material. There is little or no hazard of erosion.

More than 75 percent of this soil is seeded to clover and grass for hay and pasture. Oats, barley, and spring wheat are also grown. Grass and small grain respond to nitrogen fertilizer. Legumes respond to sulfur. (Capability unit IVw-1; Wet Meadow range site; not in a woodland group)

Peone silt loam, drained, 0 to 5 percent slopes (PoA).—The drainage of all but a small part of this soil has been improved by artificial means or by natural stream cutting and is now somewhat poor rather than poor. Surface runoff is slow. A few places are subject to flooding and receive deposits of fresh material. Tillage is delayed slightly in the spring because of wetness.

Most of the acreage is cultivated. The main crops are wheat, barley, and oats, and grass and clover for hay and pasture. Some alfalfa and peas are grown. All crops except legumes respond to nitrogen; legumes respond to sulfur. (Capability unit IIIw-1; not in a woodland group or range site)

Phoebe Series

The Phoebe series consists of well-drained, moderately coarse textured soils on nearly level to moderately steep outwash terraces. These soils formed in sandy glacial outwash mixed with loess and volcanic ash, under grass. The annual precipitation is 15 to 25 inches, and the frost-free season is about 140 days. Most areas of Phoebe soils receive 18 to 25 inches of precipitation annually. Those areas mapped in complexes or in undifferentiated groups with Bong soils, and described following the description of the Bong series, receive 15 to 18 inches of precipitation annually.

Phoebe soils are used for a variety of crops. Part of the acreage is irrigated.

Phoebe sandy loam, 0 to 5 percent slopes (PsA).—This is one of the dominant soils on Wild Rose and Half Moon Prairies. Most slopes are between 2 and 5 percent; the steeper slopes are along drainageways and terrace breaks. The annual precipitation is 18 to 25 inches. Representative profile:

0 to 16 inches, black, very friable sandy loam, very dark brown below a depth of 8 inches; granular structure in the upper 8 inches; slightly acid.
16 to 34 inches, dark-brown, very friable fine sandy loam; below a depth of 25 inches, dark yellowish-brown, very friable sandy loam; neutral.
34 to 44 inches, dark yellowish-brown very friable loamy sand; neutral.
44 to 60 inches +, yellowish-brown sand, almost loamy sand; neutral.

The surface layer and subsoil are sandy loam or fine sandy loam. A few thin, discontinuous bands of dark-brown loam occur in places at a depth of more than 24 inches. A few small, waterworn pebbles are present in some places. As much as 5 percent of some areas consists of Bong, Clayton, or Garrison soils.

This soil is well drained and has moderately rapid permeability. It holds about 7 or 8 inches of water that plants can use. It is high in fertility and easy to work. Root penetration is very deep. Surface runoff is slow. There is little or no hazard of water erosion but a slight hazard of wind erosion.

More than 95 percent of the acreage is cultivated and some of it is irrigated. The rest is used as farmsteads. Crops grown without irrigation are wheat, oats, barley, potatoes, alfalfa, and grass. Wheat, oats, barley, alfalfa, and grass grown for seed are also grown under irrigation, as are row crops, orchards, and berries. Yields are high. All crops except legumes respond to nitrogen; legumes may respond to sulfur. (Capability unit IIe-4; Loamy range site; not in a woodland group)

Phoebe sandy loam, 5 to 20 percent slopes (PsB).—The surface layer of this soil is 2 to 5 inches thinner than that of Phoebe sandy loam, 0 to 5 percent slopes. Surface runoff is medium, and the hazard of water erosion is moderate. Small areas of Clayton fine sandy loam were included in mapping.

This soil is used in about the same way as Phoebe sandy loam, 0 to 5 percent slopes. (Capability unit IIIe-5; Loamy range site; not in a woodland group)

Reardan Series

The Reardan series consists of well-drained soils that have a silty clay subsoil. This layer is extremely firm, very sticky, and very plastic. These soils formed in layered loess mixed with volcanic ash, under grass. They are on nearly level to moderately steep uplands. The annual precipitation is 15 to 18 inches, and the frost-free season is about 130 days.

Reardan soils are used for grain, peas, alfalfa, and grass.

Reardan silt loam, 5 to 20 percent slopes (RdB).—This soil occurs in the loess areas in the western and southwestern parts of the county. Most slopes are between 6 and 15 percent; there are a few slopes of more than 20 percent, and some of less than 5 percent. Most areas of this soil are on the foot slopes with Cheney and Athena soils. Representative profile:

0 to 16 inches, very dark brown, friable silt loam, very dark grayish-brown below a depth of 9 inches.
16 to 20 inches, dark grayish-brown friable silt loam that breaks into prisms 1 to 2 inches wide and then into subangular blocks 1/4 to 1 inch wide; neutral.

20 to 33 inches, dark yellowish-brown, extremely firm light silty clay that breaks into prisms 1½ to 3 inches wide and then into angular blocks ½ to 1 inch wide; clay films on prisms and angular blocks; neutral.
33 to 60 inches, dark yellowish-brown, friable silt loam; moderately alkaline and slightly calcareous.

The surface layer ranges from very dark brown to black. The texture of the subsoil ranges from heavy silty clay loam to silty clay. Lime is at a depth of 36 to 50 inches. In many areas at lower elevations, there is granitic coarse sand 1 to 2 millimeters in size; the greatest concentration is just above the claypan. As much as 5 percent of some areas consists of Athena, Cheney, Dragoon, or Uhlig soils.

This soil is well drained and slowly permeable. It holds 9 to 11 inches of water that plants can use. The fertility is high. Surface runoff is medium, and the hazard of erosion is moderate. Roots penetrate the silty clay layer with difficulty, mostly along cleavage planes. This soil is easy to work, but tillage in spring is often delayed by wetness.

More than 95 percent of the acreage is cultivated; the rest is seeded to pasture. Wheat is the chief cash crop. In most places it is grown in a wheat-fallow rotation, but in some areas dry field peas are included in the rotation. Other crops grown are barley and oats, alfalfa for hay or green manure, and grass for pasture or hay. All crops except legumes respond to nitrogen. Some crops, especially legumes, respond to sulfur and phosphorus. (Capability unit IIIe-1; Loamy range site; not in a woodland group)

Reardan silt loam, 0 to 5 percent slopes (RdA).—The surface layer of this soil is 3 to 5 inches thicker than that of Reardan silt loam, 5 to 20 percent slopes. Surface runoff is slow; the erosion hazard is slight. Small areas of Cheney and Dragoon soils were included in mapping.

This soil has more uses than Reardan silt loam, 5 to 20 percent slopes. (Capability unit IIc-1; Loamy range site; not in a woodland group)

Reardan silt loam, 5 to 20 percent slopes, eroded (RdB2).—In most areas of this soil, 30 to 60 percent of the original surface layer has been removed by erosion. The fertility is medium.

The same crops are grown as on Reardan silt loam, 5 to 20 percent slopes, but yields of most crops are lower. (Capability unit IIIe-1; not in a woodland group or range site)

Reardan silt loam, 20 to 30 percent slopes, eroded (RdC2).—The surface layer of this soil is 3 to 6 inches thinner than that of Reardan silt loam, 5 to 20 percent slopes, mainly because of erosion. Surface runoff is rapid, and the erosion hazard is severe. This soil holds 7 to 9 inches of water that plants can use. It is medium in fertility. Using farm machinery is somewhat difficult. Included in mapping were some short slopes that exceed 30 percent and some small areas of Athena and Dragoon soils.

The same crops are grown as on Reardan silt loam, 5 to 20 percent slopes, but grass and legumes are more commonly included in the rotation. (Capability unit IIIe-1; not in a woodland group or range site)

Riverwash

Riverwash (Rh).—This land type is on low bottoms along perennial and intermittent streams. It consists of gravel, cobblestones, and stones and very little finer material. The areas are flooded nearly every year by runoff from melting snow. They have little value other than serving as protection against channel cutting. (Capability unit VIIIw-1; not in a woodland group or range site)

Rock Outcrop

Rock outcrop (Ro).—More than 90 percent of this land type consists of granite, gneiss, schist, or basalt outcrops. It is used for wildlife, watersheds, and recreation. (Capability unit VIIIs-1; not in a woodland group or range site)

Schumacher Series

The Schumacher series consists of well-drained, medium-textured soils that formed in weathered shale, sandstone, and quartzite mixed in the upper part with loess and volcanic ash. These soils occupy gently sloping to very steep foot slopes and fans. The original vegetation consisted of bunchgrass and scattered ponderosa pines. The annual precipitation is 19 to 22 inches, and the frost-free season is about 130 days.

Schumacher soils are used for grain, peas, lentils, alfalfa, and grass and as range.

Schumacher silt loam, 0 to 20 percent slopes (SaB).—This is the dominant cultivated soil on the foot slopes of Tekoa Mountain. Most slopes are between 6 and 15 percent; a few are steeper. Representative profile:

0 to 11 inches, very dark brown, very friable silt loam; granular structure; medium acid.
11 to 21 inches, brown, friable gravelly silt loam that breaks into subangular blocks ¼ to ½ inch wide; medium acid.
21 to 53 inches, yellowish-brown, firm gravelly heavy loam grading to brown below a depth of 31 inches; breaks into prisms 1 to 2 inches wide, and then into subangular blocks ½ to 1 inch wide; clay films on prisms and subangular blocks; slightly acid.
53 to 72 inches, dark yellowish-brown, firm gravelly clay loam; grades to decomposing shale and sandstone at a depth of 72 inches; neutral.

The surface layer ranges from very dark brown to black in color and from 10 to 16 inches in thickness. The subsoil is 15 to 30 percent gravel. Bedrock is at a depth of 40 to more than 75 inches. In places a few pebbles occur on the surface. Included in mapping were small areas of Tekoa gravelly silt loam and Naff or Palouse silt loam.

This soil is well drained and moderately permeable. It holds 9 to 11 inches of water that plants can use. It is medium in fertility and is easy to work. Root penetration is very deep. Surface runoff is medium, and the hazard of erosion is moderate.

About 90 percent of the acreage is cultivated. Winter wheat, peas, oats, barley, alfalfa, and grass are the principal crops. All crops except legumes respond to nitrogen; legumes respond to sulfur and phosphorus. (Capability unit IIIe 2; Loamy range site; not in a woodland group)

Schumacher silt loam, 20 to 30 percent slopes (SaC).—This soil has a surface layer 2 to 4 inches thinner than that of Schumacher silt loam, 0 to 20 percent slopes. Surface runoff is medium to rapid, and the erosion hazard is severe. Using farm machinery is somewhat difficult because of the slope. Included in mapping were small areas of Tekoa gravelly silt loam and Naff and Palouse silt loam.

The same crops are grown as on Schumacher silt loam, 0 to 20 percent slopes, but grass and legumes are more common in the rotation. (Capability unit IIIe–2; Loamy range site; not in a woodland group)

Schumacher silt loam, 30 to 55 percent slopes (SaD).—This soil has a surface layer 3 to 6 inches thinner than that of Schumacher silt loam, 0 to 20 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. The use of farm machinery is difficult because of the steep slopes. Areas of Tekoa gravelly silt loam, 30 to 55 percent slopes, were included in mapping. (Capability unit VIe–1; North Exposure range site; not in a woodland group)

Schumacher gravelly silt loam, 5 to 30 percent slopes (ScC).—This soil has a surface layer 2 to 4 inches thinner than that of Schumacher silt loam, 0 to 20 percent slopes, and it contains more than 20 percent gravel. The soil holds 7 to 9 inches of water that plants can use. Surface runoff is medium, and the erosion hazard is moderate. About 5 percent of some areas consists of Tekoa gravelly silt loam and of Naff and Palouse silt loam.

The same crops are grown as on Schumacher silt loam, 0 to 20 percent slopes, but yields are less and grass and legumes are more common in the rotation. (Capability unit IVe–4; Loamy range site; not in a woodland group)

Schumacher gravelly silt loam, 30 to 55 percent slopes (ScD).—The surface layer of this soil is 3 to 6 inches thinner than that of Schumacher silt loam, 0 to 20 percent slopes. This soil holds 7 to 9 inches of water that plants can use. The use of farm machinery is difficult because of the slope. Surface runoff is rapid, and the hazard of erosion is severe. Areas of Tekoa gravelly silt loam, 30 to 55 percent slopes, were included in mapping.

This soil is suited to perennial grass and legumes. (Capability unit VIe–1; North Exposure range site; not in a woodland group)

Schumacher silt loam, 0 to 20 percent slopes, eroded (SaB2).—In most places from 30 to 50 percent of the original surface layer of this soil has been removed by erosion. Surface runoff is medium, and the erosion hazard is moderate (fig. 6).

The same crops are grown as on Schumacher silt loam, 0 to 20 percent slopes, but yields of most crops are less. (Capability unit IIIe–2; not in a woodland group or range site)

Schumacher silt loam, 20 to 30 percent slopes, eroded (SaC2).—In most places this soil has had from 30 to 50 percent of the original surface layer removed by erosion. Surface runoff is rapid, and the erosion hazard is severe.

The same crops are grown as on Schumacher silt loam, 0 to 20 percent slopes. (Capability unit IIIe–2; not in a woodland group or range site)

Schumacher gravelly silt loam, 5 to 30 percent slopes, eroded (ScC2).—This gravelly soil has had from 30 to 50 percent of the surface layer removed by erosion. It has low to medium fertility and holds 7 to 9 inches of water that plants can use. Surface runoff is medium, and the hazard of further erosion is moderate.

The same crops are grown as on Schumacher silt loam, 0 to 20 percent slopes, but yields are slightly lower.

Figure 6.—**Strips of alfalfa-grass mixture alternated with strips of grain on Schumacher silt loam, 0 to 20 percent slopes, eroded. This is an effective measure for control of runoff and erosion. Maximum width of strips is 140 feet.**

(Capability unit IVe-4; not in a woodland group or range site)

Schumacher gravelly silt loam, 30 to 55 percent slopes, eroded (ScD2).—This gravelly soil has had from 30 to 50 percent of the surface layer removed by erosion. It is not suited to cultivation but can be seeded to perennial grass and legumes. (Capability unit VIe-1; not in a woodland group or range site)

Semiahmoo Series

The Semiahmoo series consists of poorly drained and very poorly drained organic soils that formed in decomposed reeds, sedges, and other water-tolerant plants. These soils occupy nearly level flats and depressions where there are few drainage outlets. The annual precipitation is 18 to 25 inches, and the frost-free season is about 100 days.

Semiahmoo soils are used mainly for oats, clover, and grass and for grazing.

Semiahmoo muck, drained (Sk).—This is the dominant soil on the Saltese Flats adjoining Newman and Bailey Lakes, and in shallow intermittent lakes near Cheney. This soil is nearly level. Representative profile:

0 to 17 inches, black, friable muck; granular structure; medium acid.
17 to 21 inches, black, friable, fibrous peat; platy structure; plates are 1/16 to 1/8 inch thick; medium acid.
21 to 52 inches, dark reddish-brown, friable, fibrous peat that turns to dark reddish brown or black when exposed to air; medium acid.
52 to 62 inches, dark-brown, friable, disintegrating and fibrous peat that darkens rapidly to black when exposed to air; medium acid.

The thickness of the muck surface layer ranges from 7 to 24 inches. In some places near the edge of the bogs, there are layers of pumice 2 to 12 inches thick. Small areas near Bailey Lake contain appreciable amounts of snail shells and marl and are calcareous. Also mapped with this soil near Bailey Lake are depressions less than one acre in size that contain Hypnum moss peat. As much as 5 percent of some areas consists of Konner or Peone soils.

This soil is poorly drained and moderately permeable. It holds more than 11 inches of water that plants can use. It is low in fertility and easy to work. Root penetration is deep. Surface runoff is slow, and there is no erosion hazard.

The largest cultivated areas of this soil are on the Saltese Flats and near Newman Lake. Oats, grass, and clover are the main crops. Some spring wheat and barley are grown. Grass and grain crops respond to nitrogen. Uncultivated areas provide excellent summer grazing. (Capability unit IIIw-5; not in a woodland group or range site)

Semiahmoo muck (Se).—This soil is very poorly drained and is flooded during most of the growing season. It is not suitable for cultivation unless drained. (Capability unit Vw-1; Wet Meadow range site; not in a woodland group)

Semiahmoo muck, moderately shallow, drained (Sm).—This soil is moderately shallow to mineral soil, or to thick, compact layers of pumicite, or to bedrock. It holds 7 to 11 inches of water that plants can use. Roots penetrate the underlying compact layers with difficulty. (Capability unit IIIw-5; not in a woodland group or range site)

Snow Series

The Snow series is made up of very deep, dark-colored, medium-textured, well-drained soils on nearly level bottom lands and nearly level to moderately steep terraces and foot slopes. These soils formed under grass in a mixture of loess and volcanic ash or alluvium washed from soils on loessal uplands. The annual precipitation is 19 to 22 inches, and the frost-free season is 110 to 140 days.

Snow soils are used for grain, peas, lentils, alfalfa, and grass.

Snow silt loam, 0 to 5 percent slopes (SnA).—This is the dominant soil on the well-drained parts of terraces and foot slopes in the southeastern part of the county, and on the western end of Peone Prairie in the central part of the county. Representative profile:

0 to 21 inches, black, friable silt loam grading to very dark grayish brown or brown below a depth of about 8 inches; granular structure in upper 12 inches; neutral.
21 to 44 inches, dark-brown, friable silt loam; neutral.
44 to 60 inches, dark yellowish-brown, friable silt loam; neutral.

The surface layer ranges from black to very dark brown in color and from 18 to 30 inches in thickness. In places it is a very fine sandy loam. Calcareous lake sediments may occur at a depth of 48 inches or more. As much as 5 percent of some areas consists of Naff, Caldwell, Cedonia, or Bernhill soils.

This soil is well drained and moderately permeable. It holds from 9 to more than 11 inches of water that plants can use. It is high in fertility and is easy to work. Root penetration is very deep. Surface runoff is slow, and the hazard of erosion is slight.

Almost all the acreage is cultivated. Winter wheat, spring wheat, barley, oats, alfalfa, grass, peas, and clover are grown, generally in a rotation. Yields of all crops are high. Peas grown on bottom lands are sometimes injured by late spring frosts. Peas have to be planted about 2 weeks later on bottom lands than on surrounding areas, because the soil stays wet in spring. Weeds tend to encroach where peas are grown. All crops except legumes respond to nitrogen; legumes respond to sulfur and phosphorus. In some areas, wheat responds to sulfur. (Capability unit IIe-5; not in a woodland group or range site)

Snow silt loam, 5 to 30 percent slopes (SnC).—The surface layer of this soil is a little thinner than that of Snow silt loam, 0 to 5 percent slopes, and calcareous lake sediments are common in the lower part of the subsoil. Surface runoff is medium, and the erosion hazard is moderate. In most places, this soil is on toe slopes where material from higher soils accumulates.

This soil is used for the same crops as Snow silt loam, 0 to 5 percent slopes. It is better suited to peas because there is less danger of late spring frost. (Capability unit IIIe-2; not in a woodland group or range site)

Speigle Series

The Speigle series consists of well-drained, very stony, medium-textured soils. These soils formed in basalt col-

luvium mixed with loess and volcanic ash, under conifers and grass. Slopes are moderately steep to very steep. The annual precipitation is 16 to 21 inches, and the frost-free season is about 110 days.

The Speigle soils are used for producing timber, for grazing, and as wildlife habitats.

Speigle very stony silt loam, 30 to 70 percent slopes (SoE).—This is the dominant soil that formed in basalt colluvium on steep northern and eastern slopes in the western part of the county. Most slopes are between 30 and 70 percent; a few are steeper. Representative profile:

0 to 8 inches, very dark grayish-brown, very friable very stony silt loam; granular structure; neutral; undisturbed areas have an organic mat 1 inch thick on the surface.

8 to 18 inches, dark grayish-brown, friable very cobbly loam that breaks into subangular blocks 1/4 to 1/2 inch wide; neutral.

18 to 60 inches, grayish-brown, friable very cobbly heavy loam, almost sandy clay loam; neutral.

The surface layer is very dark brown to very dark grayish brown. Cobblestones and stones cover from 50 to 80 percent of the surface. The texture of the subsoil is very cobbly loam or very cobbly heavy loam. Lenses or pockets of pumicite are common in the subsoil. The amount of basalt cobblestones and stones in the subsoil ranges from 40 to 70 percent. As much as 10 percent of some areas consists of Hesseltine soils and gravelly Springdale soils.

The soil is well drained and moderately permeable. It holds 7 to 9 inches of water that plants can use. It is medium in fertility. Root penetration is very deep. Surface runoff is medium to rapid, and the hazard of erosion is severe.

This soil is too stony for cultivation. It is used for timber, for grazing, and as wildlife habitats. (Capability unit VIIs–1; woodland group 8; not in a range site)

Spokane Series

The Spokane series consists of well-drained soils that have a sandy substratum underlain by bedrock at a depth of 20 to 60 inches. These soils formed in weathered granite or thin deposits of glacial till overlying granite, under conifers and grass. They occupy nearly level to very steep mountain foot slopes. Much of the acreage is stony or rocky. The annual precipitation is 18 to 24 inches, and the frost-free season is about 110 days.

Spokane soils are used for grain, alfalfa, and grass and for grazing. They are also used as woodland and as recreational areas.

Spokane loam, 0 to 30 percent slopes (SpC).—This is the dominant soil on the south- and west-facing mountain foot slopes in the central and northeastern parts of the county. Most of the slopes are between 6 and 30 percent. Representative profile:

0 to 3 inches, very dark grayish-brown, friable loam; granular; slightly acid; undisturbed areas have an organic mat 1 inch thick on the surface.

3 to 17 inches, dark-brown, friable gravelly sandy loam to a depth of 9 inches, gravelly coarse sandy loam below; slightly acid.

17 to 25 inches, dark-brown, friable gravelly loamy coarse sand; few wavy bands of dark yellowish-brown loam 1/8 to 1/4 inch thick; neutral.

25 inches +, disintegrating bedrock that crumbles to angular sand and fine gravel.

The surface layer ranges from very dark grayish brown to dark brown in color, from 6 to 10 inches in thickness, and from loam to coarse sandy loam in texture. The subsoil texture ranges from coarse sandy loam to gravelly coarse sandy loam. Horizontal dark-brown bands, 1/8 to 1/2 inch thick, occur in the lower profile in some places. The depth to disintegrating bedrock ranges from 25 to more than 48 inches. The depth to solid bedrock is at least 30 inches and in many places more than 60 inches. As much as 15 percent of some areas consists of other Spokane soils or of Moscow and Bernhill soils.

This soil is well drained, moderately permeable, and easy to work. It holds 5 to 7 inches of water that plants can use. It is low to medium in fertility. Roots penetrate to bedrock. Surface runoff is medium, and the hazard of erosion is moderate to severe.

Less than 10 percent of the acreage is cultivated; most of it is used for woodland, grazing, or recreational purposes. Most cultivated areas are seeded to alfalfa and grass for hay or pasture. Some grain is grown, but yields are low. All crops respond to nitrogen and to a complete fertilizer. (Capability unit IVe–4; woodland group 6; not in a range site)

Spokane loam, 30 to 55 percent slopes (SpD).—This soil has a surface layer 3 to 4 inches thinner than that of Spokane loam, 0 to 30 percent slopes. Surface runoff is rapid, and the erosion hazard is severe. As much as 15 percent of some areas consists of Moscow soils or other soils of the Spokane series.

This soil is used as woodland and for limited grazing. Ponderosa pine is the main kind of tree grown for timber. Tractor logging is difficult. (Capability unit VIe–2; woodland group 6; not in a range site)

Spokane stony loam, 0 to 30 percent slopes (SrC).—Stones cover from 20 to 50 percent of the surface of this soil. The fertility is low. The available water capacity is less than 5 inches. As much as 15 percent of some areas consists of Moscow soils or of other Spokane soils, and as much as 10 percent of gneiss rock outcrops.

The soil is used as woodland and for grazing. (Capability unit VIs–1; woodland group 7; not in range site)

Spokane stony loam, 30 to 70 percent slopes (SrE).—Stones occupy from 20 to 50 percent of the surface layer and profile of this soil. The available water capacity is less than 5 inches. The fertility is low. Surface runoff is rapid, and the hazard of erosion is severe. As much as 15 percent of some areas consists of Moscow soils or other Spokane soils, and as much as 10 percent of gneiss rock outcrops.

This soil is used as woodland and for grazing. (Capability unit VIIs–1; woodland group 7; not in a range site)

Spokane complex, 0 to 30 percent slopes (SsC).—From 60 to 70 percent of this complex is moderately shallow Spokane loam; from 15 to 25 percent is Spokane loam; the rest consists of Moscow soils and other Spokane soils. The moderately shallow Spokane loam has a surface layer 1 or 2 inches thinner than that of Spokane loam, 0 to 30 percent slopes, and is 20 to 30 inches deep to bedrock. It is low in fertility and holds less than 5 inches of water that plants can use.

The acreage is used mainly as woodland and for grazing. (As a complex: capability unit VIe-2. By components: Spokane loam, moderately shallow—capability

unit VIe–2; woodland group 7; not in a range site. Spokane loam—capability unit IVe–4; woodland group 6; not in a range site)

Spokane complex, 30 to 70 percent slopes (SsE).—From 60 to 70 percent of this complex is moderately shallow Spokane loam; from 15 to 25 percent is Spokane loam that has a slope range of 30 to 55 percent; the rest consists of Moscow soils and other Spokane soils. The moderately shallow Spokane loam has a surface layer 3 or 4 inches thinner than that of Spokane loam, 0 to 30 percent slopes, and is 20 to 30 inches deep to bedrock. Surface runoff is rapid or very rapid, and the hazard of erosion is very severe.

This complex is used as woodland and for limited grazing. (As a complex: capability unit VIIe–1. By components: Spokane loam, moderately shallow—capability unit VIIe–1; woodland group 7; not in a range site. Spokane loam—capability unit VIe–2; woodland group 6; not in a range site)

Spokane very rocky complex, 0 to 30 percent slopes (StC).—From 50 to 80 percent of this mapping unit is moderately shallow Spokane loam; the rest consists of granite rock outcrops and of Moscow soils or other Spokane soils. These soils make up 15 percent of some areas. (As a complex: capability unit VIIs–2. By components: Spokane loam, moderately shallow—capability unit VIe–2; woodland group 7; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Spokane very rocky complex, 30 to 70 percent slopes (StE).—From 50 to 80 percent of this mapping unit is moderately shallow Spokane loam. The rest consists of granite rock outcrops.

The acreage is used for timber and for grazing. The use of tractors for logging is limited. (As a complex: capability unit VIIs–2. By components: Spokane soil—capability unit VIIe–1; woodland group 7; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Spokane extremely rocky complex, 20 to 70 percent slopes (SuE).—From 20 to 50 percent of this mapping unit is a moderately shallow Spokane loam that has a slope range of 30 to 70 percent. The rest consists of rock outcrops. The acreage is used for timber and for grazing. (As a complex: capability unit VIIs–2. By components: Spokane soil—capability unit VIIe–1; woodland group 7; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Springdale Series

The Springdale series consists of somewhat excessively drained, coarse textured and moderately coarse textured, gravelly and cobbly soils. These soils formed in glacial outwash mixed with some volcanic ash, under ponderosa pine and grass. They are nearly level to very steep soils on outwash terraces and flood plains. The annual precipitation is 15 to 18 inches, and the frost-free season is about 140 days.

Soils of the Springdale series are used for alfalfa, grass, and grain. They are also used for grazing and as woodland.

Springdale gravelly sandy loam, 0 to 20 percent slopes (SwB).—This is the dominant soil on the outwash terraces and glacial flood plains near Colbert and Chattaroy in the central part of Spokane County. Most slopes are between 2 and 10 percent; a few are steeper. Representative profile:

0 to 2 inches, very dark grayish-brown, very friable gravelly coarse sandy loam; granular structure; neutral; undisturbed areas have an organic mat 1 inch thick on the surface.
2 to 12 inches, dark-brown, friable gravelly coarse sandy loam; slightly acid, medium acid below a depth of 6 inches.
12 to 24 inches, dark yellowish-brown gravelly loamy coarse sand; slightly acid.
24 inches +, gravelly coarse sand.

The color of the surface layer is very dark grayish brown to very dark brown. The subsoil ranges from dark brown to dark yellowish brown in color and from gravelly sandy loam to gravelly loamy coarse sand in texture. Gravelly coarse sand is at a depth of 20 to 36 inches. In some areas cobblestones occur throughout the profile. As much as 10 percent of some areas consists of other Springdale soils; 5 percent of Bonner gravelly silt loam; and 3 percent of Clayton sandy loam.

This soil is somewhat excessively drained and has moderately rapid permeability. It holds less than 5 inches of water that plants can use. It is low in fertility. In general, it is easy to work. Roots of most plants penetrate only a few inches into the gravelly coarse sand. Surface runoff is slow, and the hazard of erosion is slight.

Most of the acreage is used as woodland and for grazing. Yields of forage are low. Less than 10 percent is cultivated, and only a few small areas are irrigated. The crops grown are alfalfa and grass for hay or pasture. Wheat or rye is grown during reestablishment of alfalfa and grass. Legumes respond to sulfur and sometimes to boron. (Capability unit VIe–2; woodland group 17; not in a range site)

Springdale gravelly loamy sand, 30 to 70 percent slopes (SzE).—This soil is moderately extensive on terrace breaks and colluvial slopes along major drainageways in the central part of the county. Representative profile:

0 to 11 inches, dark-brown gravelly loamy sand; neutral; granular structure and slightly darker color in upper 3 inches.
11 to 17 inches, brown gravelly loamy sand; few dark-brown and reddish-brown mottles; neutral.
17 to 60 inches +, brown very gravelly coarse sand; neutral.

The texture of the surface layer ranges from gravelly loamy sand to gravelly or cobbly sand. The gravel content of the subsoil ranges from 40 to 90 percent. As much as 10 percent of some areas consists of Marble loamy coarse sand, 0 to 30 percent slopes, and of other Springdale soils.

This soil is somewhat excessively drained and has moderately rapid permeability. It holds less than 5 inches of water that plants can use. The fertility is low. Root penetration is deep. The use of machinery is difficult. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used as a source of gravel for concrete. There is some grazing on the less sloping areas, but yields of forage are low. (Capability unit VIIs–1; woodland group 19; not in a range site)

Springdale gravelly sandy loam, deep, 0 to 20 percent slopes (SxB).—This soil has a surface layer 1 or 2 inches thicker than that of Springdale gravelly sandy loam, 0 to 20 percent slopes, and the depth to gravel and cobblestones is more than 36 inches. This soil holds 5 to 7 inches of water that plants can use. As much as 10 percent of some

areas consists of other Springdale soils, and as much as 8 percent consists of Bonner and Clayton soils.

This soil is used for the same crops as Springdale gravelly sandy loam, 0 to 20 percent slopes, but produces higher yields. (Capability unit IVe–5; woodland group 15; not in a range site)

Springdale cobbly sandy loam, 0 to 20 percent slopes (SyB).—This soil contains gravel and cobblestones at a depth of 20 to 36 inches. As much as 10 percent of some areas consists of other Springdale soils.

This soil is used as woodland and for grazing. (Capability unit VIIs–1; woodland group 17; not in a range site)

Tekoa Series

The Tekoa series consists of well-drained, gravelly, medium-textured soils. These soils formed under conifers and grasses in weathered sandstone, quartzite, schist, and shale. They occupy gently sloping to very steep hilly and mountainous areas. The annual precipitation is about 22 inches, and the frost-free season is about 120 days.

Tekoa soils are used for grazing, as woodland, and as wildlife habitats. A few small areas are used for grain, grass, and legumes.

Tekoa gravelly silt loam, 30 to 55 percent slopes (TeD).—This soil occurs on Tekoa Mountain and similar promontories in the county. Most slopes are between 30 and 45 percent. Representative profile:

0 to 14 inches, dark-brown, friable gravelly silt loam, granular in the upper 5 inches; neutral, grading to slightly acid below a depth of 5 inches; undisturbed areas have an organic mat 1 inch thick on the surface.

14 to 20 inches, dark-brown, friable gravelly heavy silt loam that breaks into prisms 1 to 2 inches wide and then into angular blocks 1/8 to 1/2 inch wide; medium acid.

20 to 38 inches, yellowish-brown very gravelly loam; massive or finely laminated; medium acid.

38 inches +, fractured sandstone.

The color of the surface layer is brown or dark brown. The texture of the subsoil is gravelly loam or gravelly silt loam. Fractured parent rock occurs at a depth of 24 to 40 inches. As much as 8 percent of some areas consists of Bernhill and Schumacher soils.

This soil is well drained and moderately permeable. It holds 5 to 7 inches of water that plants can use. The fertility is low. Roots penetrate to the sandstone. Surface runoff is rapid, and the hazard of erosion is severe.

None of this soil is cultivated. It is used for timber, for grazing, and by wildlife. (Capability unit VIe–2; woodland group 7; not in a range site)

Tekoa gravelly silt loam, 5 to 20 percent slopes (TeB).—The surface layer of this soil is a little thicker than that of Tekoa gravelly silt loam, 30 to 55 percent slopes. Surface runoff is medium, and the erosion hazard is moderate. Surface gravel hinders cultivation in some places. As much as 3 percent of some areas consists of Bernhill and Schumacher soils.

This soil is used mainly for timber and grazing. A few small areas are used for small grain and alfalfa, or are seeded to grass and legumes for pasture or hay. Yields are fair. Grain and grass crops respond to nitrogen; legumes respond to sulfur and phosphorus. (Capability unit IVe–4; woodland group 7; not in a range site)

Tekoa gravelly silt loam, 20 to 30 percent slopes (TeC).—This gravelly soil has medium to rapid surface runoff and a moderate to severe hazard of erosion. About 3 percent of some areas consists of Bernhill and Schumacher soils.

This soil is used primarily for timber production. Small areas are seeded to small grain or to grass and legumes for hay or pasture. (Capability unit VIe–2; woodland group 7; not in a range site)

Tekoa very rocky complex, 25 to 55 percent slopes (TkD).—From 20 to 50 percent of this mapping unit consists of sandstone outcrops; the rest is a Tekoa gravelly silt loam that has a slope range of 30 to 55 percent. The acreage is used for grazing. (As a complex: capability unit VIIs-2. By components: Tekoa soil—capability unit VIe–2; woodland group 7; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or range site)

Uhlig Series

The soils of the Uhlig series are dark colored, well drained, and medium textured. They are very deep for the most part, but bedrock is at a depth of 30 to 40 inches in some places. These soils formed under grass in glacial till mixed in the upper part with loess and volcanic ash. They occupy gently sloping to moderately steep uplands. The annual precipitation is 15 to 21 inches. The frost-free season is about 140 days.

Uhlig soils are used for grain, peas, lentils, grass, alfalfa, vegetables, and orchard fruits.

Uhlig silt loam, 5 to 20 percent slopes (UhB).—This is the dominant soil on Peone, Orchard, and Pleasant Prairies in the central part of the county, which receives 18 to 21 inches of rainfall annually. It also occurs on the glacial outwash plain in the western and southwestern parts of the county, which receive 15 to 18 inches of rainfall. Most slopes are between 6 and 10 percent; a few are steeper. Representative profile:

0 to 4 inches, black, very friable silt loam; granular structure; medium acid.

4 to 18 inches, very dark gray, very friable silt loam above a depth of 10 inches; breaks into plates 1/16 to 3/8 inch thick; slightly acid; very dark brown, very friable silt loam below a depth of 10 inches; neutral.

18 to 42 inches, dark-brown, firm loam, friable below a depth of 32 inches; breaks into subangular blocks 1/2 to 1 inch wide; neutral.

42 to 60 inches, brown, very friable very fine sandy loam; neutral.

The color of the surface layer ranges from black to very dark brown. The texture of the subsoil ranges from silt loam to very fine sandy loam. Lime occurs in places below a depth of 36 inches. In some areas as much as 15 percent of the subsoil consists of coarse granite and basalt sand, gravel, and a few cobblestones. In places a gravelly and sandy layer is present at a depth of 36 to 48 inches. As much as 10 percent of some areas consists of Bernhill, Cheney, Snow, and Hesseltine soils.

This soil is well drained and moderately permeable. It holds 7 to 11 inches of water that plants can use. The fertility is high. Root penetration is very deep. There is no difficulty in the use of farm machinery. Surface runoff is medium, and the hazard of erosion is moderate.

More than 95 percent of the acreage is cultivated; the rest is used for grazing and as farmsteads. Grass seed and wheat are the principal crops. Other important crops are barley, oats, grass, legumes, vegetables, and orchard fruits. All crops except legumes respond to nitrogen. Specialized crops respond to trace elements. (Precipitation 15 to 18 inches—capability unit IIIe–2; precipitation 18 to 21 inches—capability unit IIIe–1; Loamy range site; not in a woodland group)

Uhlig silt loam, 0 to 5 percent slopes (UhA).—This soil has a surface layer 2 to 4 inches thicker than that of Uhlig silt loam, 5 to 20 percent slopes, and the depth to lime is more than 60 inches. Surface runoff is slow, and the erosion hazard is slight. Small areas of Cheney, Nez Perce, Bernhill, Reardan, and Hesseltine soils were included in mapping.

The same crops are grown as on Uhlig silt loam, 5 to 20 percent slopes, but more vegetables are grown and yields are slightly higher. (Precipitation 15 to 18 inches—capability unit IIe–1; precipitation 18 to 21 inches—capability unit IIe–2; Loamy range site; not in a woodland group)

Uhlig silt loam, moderately shallow, 5 to 30 percent slopes (UmC).—This soil has a surface layer 3 to 5 inches thinner than that of Uhlig silt loam, 5 to 20 percent slopes. Bedrock is at a depth of 30 to 40 inches, and the lower subsoil is gravelly. Roots penetrate to the gravel or bedrock. This soil holds 5 to 7 inches of water that plants can use. It has medium fertility. Small areas of Bernhill soils were included in mapping.

Most of the acreage is seeded to small grain, to grass for seed, and to alfalfa and grass for hay and pasture. (Capability unit IIIe–4; Shallow range site; not in a woodland group)

Vassar Series

The Vassar series consists of well-drained, medium-textured soils underlain by gneiss bedrock below a depth of 36 inches. These soils formed in coarse loess and volcanic ash, under conifers. They occupy rolling to very steep mountainous areas. The annual precipitation is 30 to 47 inches. The frost-free season is 60 to 90 days.

Soils of the Vassar series are used for woodland, wildlife, recreational, and watershed purposes.

Vassar silt loam, 30 to 55 percent slopes (VaD).—This is the dominant soil above an elevation of 3,000 feet near Mount Spokane. Representative profile:

0 to ½ inch, dark grayish-brown very friable loam, light brownish gray when dry; medium acid; undisturbed areas have an organic mat 1½ inches thick on the surface.
½ inch to 22 inches, dark-brown, very friable silt loam in upper part, loam below a depth of 15 inches; medium to slightly acid.
22 to 55 inches, pale-brown, friable gravelly loam; medium acid.
55 inches +, gneiss bedrock.

The bleached surface layer is absent in some places and as much as 1 inch thick in others. Gneiss bedrock is at a depth of 36 to 60 inches or more. As much as 5 percent of some areas is Vassar silt loam, 0 to 30 percent slopes, and as much as 1 percent consists of gneiss rock outcrops. At lower elevations, as much as 10 percent is Moscow silt loam.

This soil is well drained and moderately permeable. It holds 5 to 7 inches of water that plants can use. The fertility is medium. Roots penetrate to bedrock. Surface runoff is rapid, and the hazard of erosion is severe.

None of this soil is cultivated. It is suited to forestry. Tractor logging is difficult because of the slope. (Capability unit VIe–2; woodland group 1; not in a range site)

Vassar silt loam, 0 to 30 percent slopes (VaC).—This soil has medium surface runoff. The hazard of erosion is moderate. As much as 5 percent of some areas is Moscow silt loam, and 1 percent consists of gneiss outcrops.

This soil is suitable for woodland. There is no difficulty in the use of tractors for logging. A small acreage has been cleared and seeded to small grain, grass, and alfalfa for hay. (Capability unit VIe–2; woodland group 1; not in a range site)

Vassar very rocky silt loam, 20 to 55 percent slopes (VsD).—From 40 to 80 percent of this mapping unit is Vassar silt loam, 30 to 55 percent slopes; the rest consists of gneiss rock outcrops. The acreage is used for producing timber. (As a complex: capability unit VIIs–2. By components: Vassar soil—capability unit VIe–2; woodland group 1; not in a range site. Rock outcrops—capability unit VIIIs–1; not in a woodland group or a range site)

Wethey Series

The Wethey series consists of nearly level, somewhat poorly drained and poorly drained sandy soils along streams. These soils formed in alluvium derived principally from granite and argillite, under grass, reeds, and aspen. The annual precipitation is 18 to 22 inches. The frost-free season is about 100 days.

Wethey soils are used for spring grain, alfalfa, clover, and grass and as range.

Wethey loamy sand (We).—This is the dominant soil along Wethey Creek and the southern end of Dragoon Creek. The nearly level topography is cut by many sloughs and abandoned stream channels. Representative profile:

0 to 23 inches, light-gray to black, grayish-brown, and brown, loose, stratified loamy sand and sand; neutral.
23 to 45 inches, very dark brown, very friable fine sandy loam or loamy fine sand; dark-brown mottles; neutral.
45 to 60 inches, very dark gray, friable loam; dark-brown mottles; neutral.

As much as 5 percent of some areas consists of Bridgeson silt loam, drained, or Wethey loamy sand, drained.

This soil is poorly drained and moderately permeable. The depth to the water table ranges from 36 to 65 inches. The soil holds 5 to 7 inches of water that plants can use and is low in fertility. Root penetration is limited by the water table. Surface runoff is very slow, and there is little or no hazard of erosion. Floods commonly occur during spring runoff and deposit fresh material on the surface.

This soil is suited to grass and clover. Grass responds to nitrogen, and clover responds to sulfur. (Capability unit Vw–1; Wet Meadow range site; not in a woodland group)

Wethey loamy sand, drained (Wh).—Because drainage has been improved by stream cutting or by artificial means, this soil is now somewhat poorly drained rather than poorly drained. As much as 5 percent of some areas consists of Bridgeson silt loam or undrained Wethey soil.

This soil is used for grain, alfalfa, and grass. Grain and grass crops respond to nitrogen; alfalfa responds to

sulfur. (Capability unit IIIw-4; not in a woodland group or range site)

Wolfeson Series

The Wolfeson series consists of imperfectly drained, dark-colored soils in depressions, drainageways, and gently sloping areas along drainageways. These soils formed under conifers in glaciofluvial materials derived from granitic rocks, argillite, and volcanic ash overlying stratified lake sediments. The annual precipitation is 22 to 24 inches, and the frost-free season is about 90 days.

Wolfeson soils are used for spring grain, clover, and grass and as woodland.

Wolfeson very fine sandy loam (Wo).—This soil occurs in the northwestern part of the county in slight depressions, drainageways, and gently sloping areas along drainageways. Representative profile:

0 to 7 inches, very dark grayish-brown, very friable very fine sandy loam; granular structure; slightly acid.

7 to 35 inches, brown, friable fine sandy loam, firm below a depth of 17 inches; dark-brown mottles; two wavy bands of dark-brown loam 1/8 inch thick occur at a depth of 17 to 35 inches; neutral.

35 to 44 inches, grayish-brown, firm clay loam that breaks into prisms 1 to 2 inches wide and then into subangular blocks 1/2 to 1 inch wide; dark-brown mottles; clay films on prisms and subangular blocks.

44 to 51 inches, olive-brown, loose loamy fine sand; dark-brown mottles; neutral.

51 to 60 inches, brown, firm silty clay loam that breaks into prisms 1 to 2 inches wide and then into subangular blocks 1/4 to 1/2 inch wide; dark-brown mottles; neutral.

The texture of the surface layer is very fine sandy loam or fine sandy loam. Thin, horizontal, wavy bands are common below a depth of 12 inches. In places, especially near the bands, some weak cementation is apparent. The depth to the stratified substratum normally is 35 inches but ranges from 24 to 48 inches. The substratum is heavy silt loam to silty clay loam, and in some places a few pebbles occur immediately above it. As much as 10 percent of some areas consists of Laketon and Clayton soils.

This soil is somewhat poorly drained and slowly permeable. It holds 5 to 7 inches of water that plants can use. It has low fertility. Root penetration is restricted by wetness and by the slowly permeable subsoil. Surface runoff is very slow, and a few areas are ponded at times. There is little or no hazard of erosion.

This soil is used for spring grain or is seeded to grass and clover for hay and pasture. Pastures are poor. Winter grain and alfalfa are not suited. Grain and grass respond to nitrogen, and nitrogen is beneficial in establishing clover. Clover also responds to sulfur. (Capability unit IIIw-3; woodland group 18; not in a range site)

Use and Management of Soils

This section is concerned with the use and mangement of soils for crops and pasture, as woodland, as range, and for engineering purposes. In the first three parts—crops and pasture, woodland, and range—the soils are grouped according to their suitability for these uses, the system for each grouping is explained, and the management for each group is suggested. The first part also contains a table that gives estimates of yields of the principal crops. The fourth part contains data that show the suitability of the soils for engineering purposes.

Crops and Pasture

Agriculturally, Spokane County is divided into four major areas—the southeastern, the western, the central valley, and the northeastern. Each area has conservation problems peculiar to it, and a different kind of farming must be developed for each.

Southeastern area.—This is an area of deep soils that are used in nonirrigated, annual cropping on large farms. Controlling erosion is the major conservation problem. Controlling weeds and maintaining the level of fertility and organic matter are secondary problems.

Water erosion is closely related to the practices used in growing winter grain. Severe erosion occurs on the steeper slopes that are planted to fall wheat or barley after clean cultivation, fallowing, growing a green-manure crop, or growing dry field peas; and the extent of erosion decreases in the order of the practices mentioned. The more the soil is pulverized by tillage before seeding, the greater the loss of soil is likely to be. Losses of 50 tons of soil per acre in a single season have been reported, although the present average loss is between 12 and 15 tons per acre. The annual loss of soil can be reduced to between 3 and 5 tons an acre if conservation practices are applied in the proper combination.

Returning all crop residues to the soil helps to maintain the content of organic matter. Residues should be mixed through the tillage layer, and 25 to 40 percent left on the surface. Limiting the number of tillage operations in the preparation of a seedbed helps to control pulverization. Turning the furrow slice uphill rather than downhill reduces or eliminates removal of soil by plowing. Seeding on the contour is especially important on slopes of 5 to 20 percent that are 300 feet or more in length. Growing grass and legumes in the rotation between crops of grain and peas, instead of fallowing, provides a protective cover. Using commercial fertilizer in accordance with soil tests or field experience helps produce a good protective cover, makes possible the use of all available moisture and reduces the amount of tillage otherwise necessary.

Runoff interception and water disposal are needed on most fields. Grassed waterways should be established in field draws that are apt to be gullied by runoff. Field diversions or gradient terraces are needed on slopes of 5 to 15 percent that are 300 feet or more in length.

Stripcropping is needed on cultivated slopes that have suitable topography and are long enough for two or more strips. Tile drainage is needed to intercept seepage above bottom lands that do not have good drainage. Field windbreaks on sharp ridges or hills help to trap snow and prevent it from forming deep drifts on steep, leeward slopes.

Western area.—This area consists mostly of channeled scablands. The deeper soils are cultivated and used for nonirrigated farming. The farms are large. Rainfall in much of this area is slightly less than is needed to make annual cropping consistently practical. The most practical cropping system is one in which winter grain alternates with stubble-mulch fallow, but this system necessitates special attention to control of erosion. Conservation benefits can be obtained by adding a mixture of alfalfa and grass to this system. The rotation would then consist of

221-715—68——4

sod for 3 to 5 years, followed by grain and fallow for twice as many years.

Runoff interception and water-disposal practices can be applied to most of the cropland. Grassed waterways are needed as outlets for diversion terraces or gradient terraces and for the control of gully erosion in field draws. Many of the slopes are suitable for contour cropping or field stripcropping. Strips of grain-fallow should alternate with strips of grass. After fall grain is seeded, at least 1,000 pounds of surface residue should be left on soils that are in the slope range of 12 to 20 percent, and at least 2,000 pounds on soils in the slope range of 20 to 30 percent. Keeping tillage to the minimum during the fallow season helps to control pulverization of soil. Fertilizing the soil makes possible the efficient use of available moisture and produces a good protective cover. During seasons when moisture is favorable and on soils that hold a good supply of moisture, annual cropping is preferable to alternate cropping and fallow.

Small meadows of tillable muck scattered through the channeled scablands are used for hay and pasture in support of a sizable dairy industry. Proper regulation of drainage is essential on these soils to obtain optimum forage yields and at the same time control deterioration of the muck soils.

Central valley area.—This area, which consists of a broad, nearly level valley floor and surrounding plateaus and foothills, is rapidly becoming urban. It is an area of sandy and gravelly soils used mostly for irrigated crops and pasture in small holdings, many only 5 to 10 acres in size. Some horses and other livestock are kept on the seeded pasture and hayland.

Conservation problems are few because most of the acreage is in a grass or grass-legume cover and is irrigated with sprinklers. Increasing runoff from paved areas and from roofs of buildings would be a major problem were it not for the fact that most of the soils are gravelly or sandy and fairly permeable.

A sizable acreage on the Green Bluff plateau is used for orchards, berries, and vegetables. The orchards are mostly nonirrigated, and they are likely to erode because the rainfall is insufficient to justify use of good cover crops. Rotary subsoiling is used to advantage to check winter runoff when the soil is frozen, and on some slopes diversion terraces and grassed waterways are needed to dispose of runoff.

The vegetable crops are mostly rill irrigated. Proper irrigation and fertilization of these crops are important.

The foothills, formerly a grain crop area, are now the center for producing turfgrass seed in the Northwest. Thus, the erosion problem has greatly reduced. Should the area ever revert to grain farming, diversion terraces and stripcropping would be needed on many of the slopes because of rapid runoff. Infestation of noxious weeds is now the most severe problem. The sod webworm bothers turfgrass but is controlled by burning off the grass residues soon after harvest.

Irrigation water is obtained from wells, from Newman Lake, and from the Spokane River. The water from these sources is low in salt content and is of excellent quality for irrigation. Since 1949 there has been a trend toward sprinkler irrigation, which applies and distributes water efficiently and does not cause erosion. The quantity of water used for each irrigation should be determined by the moisture-holding capacity of the soil. The timing of irrigation should be based on crop needs and weather conditions.

Northeastern area.—The soils in this area are used mainly for grain-livestock-woodland farming, but the enterprises are varied and the farms are small and medium sized. Both irrigated and nonirrigated farming are practiced. Sprinkler irrigation is increasing, mostly in the production of pasture, hay, and silage for dairy and beef cattle. There is a profitable market for timothy hay for horses that are kept in the urban areas near Spokane.

A few farms specialize in producing grain, and the sloping soils on these farms are subject to erosion if fall grain is planted on fallow ground. Erosion can be controlled by increasing the use of grasses and legumes in the rotation, by keeping tillage to a minimum and by using grassed waterways, diversion terraces, and other systems that control runoff.

In a few soils conditions adverse to alfalfa have developed. Much soil has been lost by erosion, and the remaining soil has been compacted by tillage. Consequently, alfalfa does not grow well. Preliminary research indicates that deep plowing that mixes the soil to a depth of 3 feet is one method of correcting the problem.

Capability groups of soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. The eight capability classes are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management.

Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIe–2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations, but without consideration of major and generally expensive land-forming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system and the subclasses recognized in Spokane County are described as follows:

Class I. Soils that have few limitations that restrict their use.
- (No subclasses) There are no Class I soils in Spokane County.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils subject to moderate erosion if they are not protected.
- Subclass IIw. Soils that have moderate limitations because of excess water.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
- Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.
- Subclass IIIw. Soils that have severe limitations because of excess water.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.
- Subclass IVw. Soils that have very severe limitations because of excess water.

Class V. Soils that are not likely to erode but have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass Vw. Soils too wet for cultivation; drainage or protection is not feasible.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass VIe. Soils severely limited, chiefly by risk of erosion, if protective cover is not maintained.
- Subclass VIs. Soils generally unsuitable for cultivation and limited for other uses by low moisture capacity, stones, or other features.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife.
- Subclass VIIe. Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.
- Subclass VIIs. Soils very severely limited by low water-holding capacity, stones, or other soil features.

Class VIII. Soils and landforms that have limitations that, without major reclamation, preclude their use for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.
- Subclass VIIIw. Extremely wet or marshy land.
- Subclass VIIIs. Rock or soil materials that have little potential for production of vegetation.

Management by capability units

In this section each capabiilty unit in Spokane County is described, and use and management of the soils are discussed. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series are in the unit. To find the names of all of the soils in any given capability unit, refer to the guide to mapping units at the back of this report.

CAPABILITY UNIT IIe–1

This capability unit consists of deep and very deep, well-drained soils of the Athena, Reardan, and Uhlig series. These soils are high in fertility and very high in water-holding capacity. They have moderate to slow permeability. The slope range is 0 to 5 percent. Surface runoff is slow, and the hazard of erosion is slight. The annual precipitation ranges from 15 to 18 inches, and the frost-free season from 130 to 140 days.

These soils are suited to wheat, barley, oats, peas, and forage seed crops and to grass and legumes for hay and pasture. Wheat, barley, and oats are the major crops. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain or grain and peas 6 to 10 years.
- Grass for seed 4 to 6 years; then grain or grain and peas 6 to 10 years.
- Grass-legume mixture 1 year; green manure 1 year; grain 1 year; and peas 1 year.

Grain or peas can be grown without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slopes, and fall grain is seeded early. If no cover crop is grown and no stubble is standing, the surface of the soil should be kept rough and cloddy during winter. Diversion terraces, field terraces, or stripcropping are necessary to control erosion on moderate and long slopes that lack a grass or legume cover. If steeper soils are upslope from these soils, a system of field terraces or diversion terraces may be necessary to intercept runoff. Growing grass and legumes in rotation helps to control erosion and to maintain or improve tilth.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if the soils are cultivated for weed control only when weeds are visible. Tillage of the Reardan soil may have to be delayed in spring because of a water table perched above the subsoil.

Grain and grass respond to nitrogen. Legumes may respond to sulfur, boron, and phosphorus. Grain, particularly when grown 2 years or more in succession, has responded to sulfur.

CAPABILITY UNIT IIe-2

This capability unit consists of soils of the Cedonia, Glenrose, Green Bluff, and Uhlig series. These soils are well drained or moderately well drained and have moderate or moderately slow permeability. They are medium to high in fertility and have a high or very high water-holding capacity. Root penetration is deep or very deep. The slope range is 0 to 5 percent, surface runoff is slow, and the hazard of erosion is slight. The annual precipitation ranges from 18 to 21 inches, and the frost-free season is about 140 days.

These soils are suited to wheat, barley, oats, peas, and lentils, to orchard and berry crops, to forage seed crops, to grass and legumes for hay and pasture, and to root and vegetable crops. They are also suited to a variety of trees and shrubs. Wheat, barley, oats, grass seed, and peas are the major crops grown. Orchard fruits, berries, and vegetables are grown mostly on the Green Bluff and Uhlig soils. Late frosts occasionally damage grass seed crops and grain on the Cedonia soil. This soil is not suited to tree fruits or berries. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain and peas, lentils, or vegetables 6 to 10 years.
- Grass for seed 4 to 6 years; then grain, grain and peas, lentils, or vegetables 2 to 10 years.
- Grass-legume mixture seeded with grain, lentils, or peas 1 year; green manure 1 year; and grain, peas, lentils, or vegetables 1 year.
- Orchards or vineyards with minimum cultivation for weed control.

These soils can be without a grass or legume cover during winter without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, fall grain is seeded early, and tillage is on the contour or across the slope. If no cover crop is grown and no stubble is standing, the surface should be kept rough and cloddy during winter. Diversion terraces, field terraces, or stripcropping, singly or in combination, are needed to control erosion on long slopes that do not have a grass or legume cover through the winter. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if the soils are cultivated for weed control only when weeds are visible.

Legumes may respond to sulfur, boron, and phosphorus. All other crops respond to nitrogen. In some areas wheat responds to sulfur, particularly if this crop is grown 2 years or more in succession. Grass grown for seed responds to sulfur if nitrogen is applied liberally. Some fruit trees respond to boron.

CAPABILITY UNIT IIe-3

This unit consists of very deep, well-drained soils of the Larkin and Naff series. These soils are medium to high in fertility and very high in water-holding capacity. Permeability is moderate or moderately slow. The slope range is 0 to 5 percent, surface runoff is slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation ranges from 18 to 23 inches, and the frost-free season from 125 to 140 days.

These soils are suited to wheat, barley, oats, peas, lentils, and forage seed crops, and to grass and legumes for hay or pasture. Wheat, barley, oats, peas, and lentils are the major crops grown. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain and peas or grain and lentils 6 to 10 years.
- Grass for seed 4 to 6 years; then grain and peas or grain and lentils 6 to 10 years.
- Grass-legume mixture seeded with peas or grain 1 year; green manure 1 year; grain 1 year; and peas or lentils 1 year.

These soils can be without a grass or legume cover during winter without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slope, and fall grain is seeded early. If no cover crop is grown and no stubble is standing, the surface should be kept rough and cloddy during winter. Stripcropping, diversion terraces, or field terraces, either singly or in combination, are necessary to control erosion on moderate and long slopes that lack a winter cover. If steeper soils are upslope from these soils, a system of field terraces or diversion terraces may be necessary to intercept runoff. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if tillage for weed control is limited to the time when weeds are visible.

Grain and grass crops respond to nitrogen. Legumes respond to sulfur and, in some areas, to phosphorus. In some places wheat responds to sulfur and phosphorus, particularly where this crop is grown year after year.

CAPABILITY UNIT IIe-4

This capability unit consists of one soil of the Phoebe series. This soil is well drained and has moderately rapid permeability. The water-holding capacity and fertility are high. The slope range is 0 to 5 percent. Runoff is slow, and there is little or no hazard of water erosion and a slight hazard of wind erosion. The annual precipitation is 18 to 25 inches, and the frost-free season is about 140 days.

Under dryland farming, this soil is suited to wheat, oats, barley, and potatoes, to grass and legumes for hay and pasture, and to grass for seed. If irrigated, this soil is suited to row crops, to orchard fruits and berries, to wheat, barley, oats, and alfalfa, and to grass for seed. Wheat and barley are the major crops grown.

Examples of suitable cropping systems for dryland farming are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain 6 to 10 years.
- Grass for seed 4 to 6 years; then grain 2 to 10 years.
- Legumes or a grass-legume mixture seeded with peas 1 year; green manure 1 year; and grain 1 year.

Examples of suitable cropping systems for irrigated land are—

- Alfalfa or alfalfa and grass 3 to 5 years; then strawberries or vegetables 3 to 5 years.
- Grass for seed 4 to 6 years; then grain 1 or 2 years.
- Orchard fruits and berries, with minimum cultivation for weed control.

This soil can be without a grass or legume cover during most winters without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, and fall grain is seeded early. Where slopes are long, tilling on the contour or across the slope is also needed. With careful management, some farmers have cropped this soil annually and summer fallowed every third year for weed control. Although a tillage pan generally is not a serious problem, chiseling may be needed every few years to break the pan. A pan is less likely to form if the soil is tilled for weed control only when weeds are visible.

Irrigation water can be applied by sprinklers, corrugations, or furrows. The timing of irrigation depends on crop needs and weather conditions. All crops except legumes respond to nitrogen. Legumes may respond to sulfur and boron. Wheat and also grass grown for seed have responded to sulfur when nitrogen was applied liberally.

CAPABILITY UNIT IIe-5

This unit is made up of very deep, well-drained, moderately permeable soils of the Mondovi and Snow series. These soils have a very high water-holding capacity and are high in fertility. The slope range is 0 to 5 percent. Surface runoff is slow, and the hazard of erosion is slight. The annual precipitation is 15 to 22 inches. The frost-free season is about 120 days.

These soils are suited to wheat, barley, oats, alfalfa, clover, and grass. Except for clover, these are the main crops grown. Peas are grown also, but they grow well only on uplands. Because of wetness in spring, peas grown on bottom lands must be seeded about 2 weeks later than on surrounding higher areas. At times they are injured by frosts late in spring. In addition, weeds tend to encroach where peas are grown.

A suitable cropping system consists of legumes or a grass-legume mixture 3 to 5 years; then grain or grain and peas 6 to 10 years; and occasional summer fallow for weed control.

These soils can be without a grass or legume cover during most winters without the hazard of excessive runoff or erosion, provided waterways are shaped and seeded to grass (fig. 7), fall grain is seeded early, all crop residues are returned to the soil, and the surface is left rough and cloddy through the winter if a spring crop is to be grown. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth. If there are steeper soils upslope, diversion terraces may be necessary to intercept runoff.

Although tillage pans are not generally a serious problem, chiseling may be needed every few years to break pans. A pan is less likely to form if the soils are tilled for weed control only when weeds are visible.

Grain and grass respond to nitrogen. Legumes generally respond to sulfur and, in some places, to phosphorus. In some places wheat responds to sulfur.

CAPABILITY UNIT IIe-6

This capability unit consists of very deep, well drained and moderately well drained soils of the Clayton and Laketon series. These soils have moderate to moderately slow permeability. The fertility is medium, and the water-holding capacity is high to very high. The slope range is 0 to 5 percent. Surface runoff is slow, and the hazard of erosion is slight. The annual precipitation ranges from 20 to 24 inches, and the frost-free season from 100 to 110 days.

Figure 7.—**Runoff water causing serious erosion on Mondovi silt loam. Athena silt loam, 5 to 30 percent slopes, in background. A diversion at base of Athena soil would have controlled erosion.**

These soils are suited to wheat, barley, oats, potatoes, alfalfa, and grass. Alfalfa and grass for hay and pasture, grass for seed, and wheat, barley, and oats are the major crops grown. Frost-sensitive crops and those requiring a long growing season are not suited to these soils. Tillage of the Laketon soils may have to be delayed for a few days in spring because of wetness.

Erosion can be controlled and good physical condition maintained by planting grain crops no more than half the time and no more than 4 years in succession; however, many farmers use the soils less intensively than this. Examples of suitable cropping systems are—

Alfalfa-grass mixture 6 to 8 years; then grain 1 or 2 years.
Alfalfa-grass mixture 3 years; grain 1 year; summer fallow 1 year; and grain 1 year.

If these rotations are used, the response of grain to nitrogen is slight. If grain follows grain, nitrogen increases yields. Legumes respond to sulfur and boron. In places crops have responded to calcium and phosphorus.

Although tillage pans are generally not a serious problem, chiseling may be needed every few years to break the pans.

CAPABILITY UNIT IIw-1

This capability unit consists of one soil of the Caldwell series. This nearly level, somewhat poorly drained soil is on bottom land. It is high in fertility and has a very high water-holding capacity. The permeability of the subsoil is moderately slow, and surface runoff is slow. This soil is often flooded for short periods in spring, and fresh soil material is deposited on the surface. The annual precipitation is 18 to 22 inches. The frost-free season is about 110 days.

This soil is suited to wheat, barley, oats, and forage seed and to grass and legumes for hay and pasture. Because of wetness and frost hazard, this soil is not suited to peas. Grass seed, wheat, barley, and oats are the major crops. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain 6 to 10 years.
- Grass for seed 4 to 6 years; then grain 6 to 10 years.
- Grass-legume mixture seeded with grain 1 year; green manure 1 year; and grain 1 or 2 years.

This soil can be without a grass or legume cover during most winters without the hazard of excessive erosion if waterways are seeded to grass, fall grain is seeded early, and all crop residues are returned to the soil. Growing grass and legumes in rotation helps to control erosion and to maintain or improve tilth. Where steeper soils are upslope, diversion terraces may be needed to intercept runoff. Chiseling may be needed every few years to break tillage pans. Random tile drains are needed where water accumulates. Stream channels should be kept clear by removing snags, gravel bars, and other debris. Protection should be provided where stream cutting is active.

Grain and grass respond to nitrogen. For winter grain, nitrogen is best applied partly in the fall and partly in the spring. Legumes generally respond to sulfur.

CAPABILITY UNIT IIw-2

This capability unit consists of soils of the Dearyton and Nez Perce series. These soils are moderately well drained and have a slowly permeable subsoil. Their water-holding capacity is moderate, and their fertility is medium. The slope range is 0 to 5 percent. Surface runoff is slow, and water ponds in places. Spring tillage is delayed because of wetness. The hazard of erosion is none to slight. The annual precipitation ranges from 21 to 23 inches, and the frost-free season from 135 to 140 days.

These soils are suited to wheat, barley, oats, peas, lentils, and forage seed and to grass and legumes for hay and pasture. Wheat, barley, oats, peas, and grass seed are the major crops. Alfalfa does not grow well unless the soils are managed carefully. Stands do poorly after about 3 years. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 2 or 3 years; then grain, grain and peas, or grain and lentils 4 to 6 years.
- Grass for seed 4 to 6 years; then grain, grain and peas, or grain and lentils 6 to 10 years.
- Legumes or a grass-legume mixture seeded with grain, peas, or lentils 1 year; then green manure 1 year; and grain, peas, or lentils 1 year.

These soils can be without a grass or legume cover during most winters without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, and fall grain is seeded early. If no cover crop is growing and no stubble is standing during winter, the surface should be kept rough and cloddy. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth. In some years winter wheat is drowned by water that collects in depressions. Random tile drains or open ditches are needed in these places.

Chiseling may be needed every few years to break tillage pans. Pans form quickly if the soils are cultivated when wet. A pan is less likely to form if the soils are tilled for weed control only when weeds are visible.

Grain and grass respond to nitrogen. Best results are obtained if nitrogen is applied partly in the fall and partly in the spring. Legumes may respond to sulfur and boron. In some areas wheat responds to sulfur.

CAPABILITY UNIT IIIe-1

This capability unit consists of deep and very deep, well-drained soils of the Athena, Dragoon, Lakesol, Lance, Reardan, and Uhlig series. These soils have moderate to slow permeability and a moderately high to very high water-holding capacity. They are medium to high in fertility. Their slope range is 0 to 30 percent. Surface runoff is medium, and the hazard of erosion is moderate to severe. The annual precipitation ranges from 15 to 20 inches, and the frost-free season from 130 to 140 days.

These soils are suited to wheat, barley, oats, peas, and forage seed crops and to grass and legumes for hay and pasture. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain or grain and peas 3 to 5 years.
- Grass for seed 4 to 6 years; then grain or grain and peas 3 to 5 years.
- Legumes or a grass-legume mixture 1 year; green manure 1 year; and grain or peas 1 year.

These soils can be without a grass or legume cover during most winters without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slope, plow furrows are turned uphill rather than downhill, and fall grain is seeded early. If no cover crop is growing and no stubble is left standing, the surface should be kept rough and cloddy during winter. Diversion terraces, field terraces, or stripcropping (fig. 8), either singly or in combination, are necessary to control erosion when wheat is alternated with fallow or on moderate and long slopes that are not protected by a grass or legume cover during winter. Growing strips of grass and legumes in the rotation helps to control erosion and to maintain or improve tilth.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if the soils are tilled for weed control only when weeds are visible.

Grain and grass respond to nitrogen, and grain may also respond to sulfur and phosphorus. Legumes may respond to sulfur, phosphorus, and boron.

CAPABILITY UNIT IIIe-2

This capability unit consists of soils of the Bernhill, Cedonia, Glenrose, Green Bluff, Larkin, Naff, Palouse, Schumacher, Snow, and Uhlig series. These soils are deep or very deep, are well drained or moderately well drained, and have a high or very high water-holding capacity. Permeability ranges from moderate to moder-

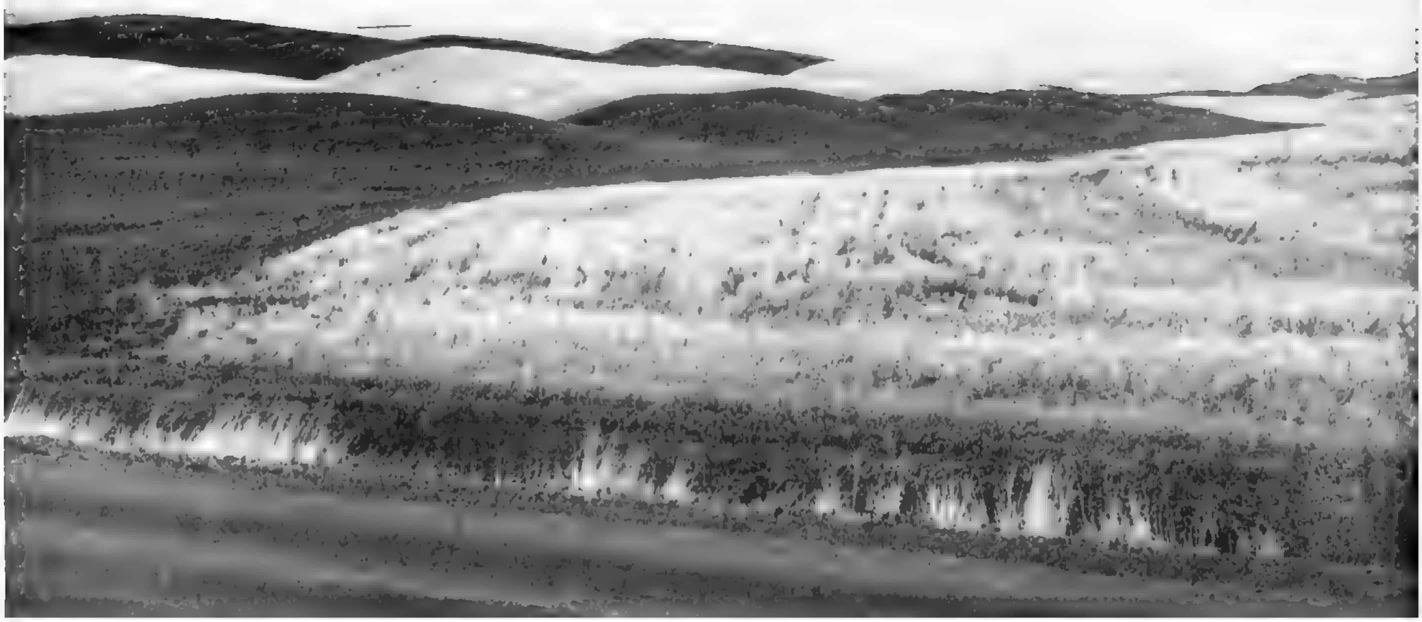


Figure 8.—**Stripcropping on Athena silt loam, 5 to 30 percent slopes; grain and alfalfa alternate with grass.**

ately slow, and fertility from medium to high. The slope range is 0 to 30 percent. Surface runoff is medium, and the hazard of erosion is moderate. The annual precipitation ranges from 18 to 25 inches, and the frost-free season from 105 to 140 days.

These soils are suited to wheat, barley, oats, peas, lentils, and forage seed crops and to grass and legumes for hay and pasture. Wheat, barley, peas, oats, lentils, and grass seed are the major crops. Orchard fruits, berries, and vegetables can be grown on Bernhill, Green Bluff, and Uhlig soils that have slopes of as much as 15 percent. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain or grain and peas 3 to 5 years.
- Grass for seed 4 to 6 years; then grain, grain and peas, or grain and lentils 3 to 5 years.
- Legumes or a grass-legume mixture seeded with grain or peas 1 year; then green manure 1 year; and grain, peas, or lentils 1 year.
- Orchards or vineyards, with annual cover crops or heavy mulches of straw or sawdust on slopes up to 15 percent on Green Bluff and Uhlig soils.

These soils can be in grain, peas, or lentils most of the time without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slope, fall grain is seeded early, and the furrow slice is turned uphill. If no cover crop is growing and no stubble is standing, the soil surface should be kept rough and cloddy during winter (fig. 9). Field stripcropping, field terraces, or diversion terraces, either singly or in combination, are needed to reduce runoff and control erosion when wheat is alternated with fallow on long slopes that are not protected by a grass or legume cover over the winter. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth.

Chiseling may be necessary every few years to break tillage pans. A pan is less likely to form if the soils are tilled for weed control only when weeds are visible. Grain and grass respond to nitrogen. Legumes may respond to sulfur and boron and occasionally to phosphorus. Wheat and grass grown for seed respond to sulfur if large amounts of nitrogen are applied. Some fruit trees respond to boron.

CAPABILITY UNIT IIIe-3

This capability unit consists of soils of the Dearyton, Freeman, and Nez Perce series. These soils are well drained and moderately well drained and they have a slowly permeable or very slowly permeable subsoil. Their water-holding capacity is moderate, and their fertility is medium. The dominant slope range is 5 to 20 percent. Surface runoff is medium, and the hazard of erosion is moderate to severe. Spring tillage often has to be delayed because of wetness. The annual precipitation ranges from 19 to 23 inches, and the frost-free season from 125 to 140 days.

These soils are suited to wheat, barley, oats, peas, lentils, and forage seed crops and to grass and legumes for hay and pasture. Wheat, barley, peas, and grass seed are the major crops grown. Alfalfa does not grow well on the Freeman soil unless carefully managed. Stands take 2 or 3 years to become established, but once a rotation has been in effect, stands are easier to reestablish. Plowing to a depth of 2½ to 3 feet and adding large quantities of lime

Figure 9.—**Photograph taken in January showing effects of seeding grain in rough seedbed on Naff silt loam, 5 to 30 percent slopes. Little erosion evident.**

and commercial fertilizer have increased alfalfa yields markedly on the Freeman soil. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain, grain and peas, or grain and lentils 3 to 5 years.
- Grass for seed 4 to 6 years; then grain, grain and peas, or grain and lentils 3 to 5 years.
- Legumes or a grass-legume mixture seeded with grain, peas, or lentils 1 year; then green manure 1 year; and grain, peas, or lentils 1 year.

These soils can be without a grass or legume cover during winter about half the time without the hazard of excessive erosion, provided waterways are seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slope, plow furrows are turned uphill rather than downhill, and fall grain is seeded early. If no cover crop is growing and no stubble is standing, the surface should be kept rough and cloddy during winter. Field stripcropping, field terraces, or diversion terraces, either singly or in combination, are needed to control erosion on long slopes that are not protected by a grass or legume cover during winter. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if the soils are tilled for weed control only when weeds are visible. Grain and grass crops respond to nitrogen. Legumes may need sulfur and boron. In some areas wheat has responded to sulfur and phosphorus, and legumes to phosphorus and calcium.

CAPABILITY UNIT IIIe-4

This capability unit consists of well-drained, moderately permeable soils in the Bernhill, Palouse, and Uhlig series. These soils are underlain by bedrock or gravel at a depth of 20 to 40 inches. Their water-holding capacity ranges from low to moderate, and their fertility from low to medium. The slope range is 0 to 30 percent. Surface runoff is slow to rapid, and the erosion hazard is slight to severe. The annual precipitation ranges from 18 to 23 inches, and the frost-free season from 105 to 140 days.

These soils are suited to wheat, barley, oats, peas, lentils, and forage seed crops and to grass and legumes for hay or pasture. Wheat, barley, peas, grass seed, and alfalfa and grass for hay and pasture are the major crops grown. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 3 to 5 years; then grain, grain and peas, or grain and lentils 3 to 5 years.
- Grass for seed 4 to 6 years; then grain, grain and peas, or grain and lentils 3 to 5 years.
- Legumes or a grass-legume mixture seeded with grain, peas, or lentils 1 year; then green manure 1 year; and grain, peas, or lentils 1 year.

Grain can be grown several years in succession or alternated with peas or lentils without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slope, the furrow slice is turned uphill rather than downhill, and fall grain is seeded early. If no cover crop is growing and no stubble is standing, the surface should be kept rough and cloddy during winter. Diversion terraces, field terraces, or stripcropping are needed to control erosion on long slopes that lack a grass or legume cover during winter.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form, however, if the soils are tilled for weed control only when weeds are visible. Keeping tillage to a minimum also helps to control erosion.

Grain and grass respond to nitrogen. Legumes may respond to sulfur and boron. In some areas wheat has responded to sulfur, and legumes to phosphorus.

CAPABILITY UNIT IIIe-5

In this capability unit are very deep, well drained and moderately well drained soils of the Clayton, Eloika, Laketon, Phoebe, and Bong series. These soils have moderately rapid to moderately slow permeability and medium to high fertility. Their water-holding capacity is high or very high. The slope range is 0 to 20 percent. Surface

runoff is slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation ranges from 18 to 25 inches, and the frost-free season from 80 to 140 days.

These soils are suited to wheat, barley, oats, and forage seed crops and to grass and legumes for hay and pasture. Most of the acreage is in a rotation of an alfalfa-grass mixture for 6 to 8 years and grain for 1 or 2 years. Frost-sensitive crops and those requiring a long growing season are not suited to the Clayton, Eloika, or Laketon soils. The main crops grown are wheat, barley, and oats, and grass and alfalfa for hay and pasture.

In some places the Phoebe sandy loam is irrigated, and a number of cool, short-season vegetable crops are grown. Examples of suitable cropping systems are—

Alfalfa or an alfalfa-grass mixture 3 to 5 years; then grain 3 to 5 years.
Alfalfa or an alfalfa-grass mixture seeded with grain 1 year; then green manure 1 year; and grain 1 year.

These soils can be without a grass or legume cover during winter about half of the time without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, fall grain is seeded early, and tillage is on the contour or across the slopes. Field terraces, diversion terraces, or stripcropping are also necessary on long slopes.

Grain and grass respond to nitrogen. Sulfur, boron, and possibly phosphorus and calcium are needed for alfalfa. Wheat responds to sulfur if large amounts of nitrogen are applied.

CAPABILITY UNIT IIIc-6

This capability unit consists of well-drained and somewhat excessively drained soils of the Bong, Cheney, Hesseltine, and Phoebe series. These soils are underlain by sand, gravel, or cobblestones below a depth of 20 inches, and they have moderate to moderately rapid permeability above this layer. Their water-holding capacity is low to medium, and their fertility is medium. The slope range is 0 to 20 percent. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The annual precipitation ranges from 15 to 25 inches, and the frost-free season from 125 to 150 days.

These soils are suited to wheat, barley, and oats, and to grass and legumes for hay or pasture. Wheat and barley, and alfalfa and grass for hay are the main crops grown. Examples of suitable cropping systems are—

Legumes or a grass-legume mixture 3 to 5 years; then grain 3 to 5 years.
Legumes or a grass-legume mixture seeded with grain 1 year; then green manure 1 year; and grain 1 year.

These soils can be without a grass or legume cover during winter about half the time without the hazard of excessive erosion, provided waterways are shaped and seeded to grass, all crop residues are returned to the soil, fall grain is seeded early, and tillage is on the contour or across the slope. On long slopes, the use of field terraces, diversion terraces, or stripcropping is also necessary. Chiseling may be needed every few years to break tillage pans. Grain and grass respond to nitrogen. Legumes may respond to sulfur and boron. Grain has responded to sulfur, and legumes to phosphorus.

CAPABILITY UNIT IIIs-1

This capability unit consists of moderately well drained Hardesty soils that formed in volcanic ash. These soils are in slight depressions and nearly level areas along drainageways. They are low in fertility, are moderately permeable, and have a low to high water-holding capacity. Root penetration is moderately deep to deep. These soils tend to become loose and powdery if cultivated when they are dry. The slope range is 0 to 5 percent. Surface runoff is very slow, and there is little or no hazard of erosion. The annual precipitation ranges from 18 to 25 inches. The frost-free season is about 110 days.

These soils are suited to wheat, barley, and oats, to root and vegetable crops, and to grass and legumes for hay and pasture. Wheat, barley, oats, and vegetables are the main cash crops.

Examples of suitable cropping systems for dryland farming are—

Legumes or a grass-legume mixture 3 to 5 years; then grain 6 to 10 years.
Legumes or a grass-legume mixture 1 year; then green manure 1 year; and grain 1 year.

Irrigated land can be used for truck crops every year. Liberal amounts of barnyard manure or other organic material should be added.

These soils can be without the protection of a grass or legume cover during winter if all crop residues are returned to the soil. Chiseling may be needed every few years to break tillage pans. Growing grass and legumes in the rotation helps to control erosion and to maintain or improve tilth.

All crops except legumes respond to heavy applications of nitrogen. Sulfur, boron, and phosphorus may be needed for legumes. In some areas wheat has responded to sulfur.

CAPABILITY UNIT IIIs-2

This capability unit consists of one soil of the Garrison series. This soil is gravelly, is somewhat excessively drained, and has moderately rapid permeability. The water-holding capacity is low or moderate, and the fertility is medium. The roots of most plants penetrate to the layer of sand, gravel, and cobblestones at a depth of 30 to 55 inches. Surface runoff is slow, and the hazard of erosion is slight. The annual precipitation ranges from 18 to 22 inches. The frost-free season is about 170 days.

Under dryland farming this soil is suited to wheat, barley, and oats and to grass and alfalfa for hay and pasture. Under irrigation it is suited to row crops, to orchard fruits and berries, to wheat, barley, oats, and alfalfa, and to grass for seed.

A suitable cropping system for dryland farming consists of legumes or a grass-legume mixture 3 to 5 years, then grain 6 to 10 years.

Examples of suitable cropping systems for irrigated land are—

Alfalfa or an alfalfa-grass mixture 3 to 5 years; then berries or vegetables 6 to 10 years.
Grass for seed 4 to 6 years; then grain 2 to 10 years.
Orchards, preferably with a permanent cover crop.

Erosion is no problem, unless this soil is irrigated by the furrow system. Grass and legumes are needed to improve tilth and fertility. Furrow irrigation is used on most of the orchards and on some row crops. Sprinklers are used

almost entirely on grass grown for seed and on hay and grain crops.

All crops except legumes respond to nitrogen. Sulfur and boron may be needed for legumes. Wheat may respond to sulfur if nitrogen is applied liberally.

CAPABILITY UNIT IIIw-1

In this capability unit are moderately well drained and somewhat poorly drained soils of the Narcisse and Peone series. These soils have moderate permeability, medium fertility, and a high water-holding capacity. Root penetration is very deep. The slope range is 0 to 5 percent. Surface runoff is slow, very slow, or ponded. Some areas are subject to overflow and deposition. The hazard of erosion is slight. Because of wetness, tillage has to be delayed in spring. The annual precipitation ranges from 19 to 26 inches. The average frost-free season is about 90 days.

These soils are suited to wheat, barley, oats, and forage seed crops and to grass and legumes for hay and pasture. The major crops grown are wheat, barley, oats, grass, and legumes. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture 2 or 3 years; then grain 4 to 6 years.
- Legumes or a grass-legume mixture seeded with grain 1 year; then green manure 1 year; and grain 1 year.

These soils can be without a grass or legume cover during most winters without excessive erosion. In a few places erosion should be controlled by shaping waterways and seeding them to grass and by seeding fall grain early. If no cover crop is growing and no stubble is standing, the surface should be kept rough and cloddy during winter. Returning all crop residues to the soil and growing grass and legumes in rotation help to maintain or improve tilth. In some years winter wheat is drowned out by water that collects in depressions. Random tile drains or open ditches are needed in such places.

Chiseling may be needed every few years to break tillage pans. Pans form quickly if the soils are cultivated when wet. A pan is less likely to form, however, if the soils are tilled for weed control only when weeds are visible. Grain and grass respond to nitrogen, and best results are obtained if nitrogen is applied partly in the fall and partly in the spring. In some areas wheat responds to sulfur. Legumes may need sulfur and boron.

CAPABILITY UNIT IIIw-2

This capability unit consists of somewhat poorly drained and poorly drained soils of the Bridgeson, Konner, and Latah series. These soils have a slowly or very slowly permeable subsoil or substratum. They are high in fertility. Root penetration is limited by the finer textured underlying material and by excess water. In many places runoff is ponded; in others, it is very slow or slow. There is little or no hazard of erosion. Spring tillage is delayed by wetness. Weeds are a problem, particularly when grain is grown. The annual precipitation ranges from 19 to 23 inches, and the frost-free season from 100 to 110 days.

These soils are suited to spring grain, clover, and grass. The major crops are spring wheat, spring barley, and oats, and clover and grass for hay and pasture. An example of a suitable cropping system is one in which clover or a grass-clover mixture is grown for 2 or 3 years, then spring grain 4 to 6 years. Many farmers grow grass and clover for 2 to 4 years, then grain for 2 years, but the soils can be used more intensively.

These soils can be without a grass or legume cover during most winters. In a few places it is necessary to control erosion by shaping waterways and seeding them to grass and by keeping the surface rough and cloddy during winter. Returning all crop residues to the soil and growing grass and legumes in rotation help to maintain or improve tilth. Stream channels should be kept clear by removing snags, gravel bars, and other obstacles. The use of riprap helps to control stream cutting. Tile or open drains can be used to remove excess water.

Tillage pans form quickly, especially if these soils are cultivated when wet. Chiseling every few years will break the pans. A pan is less likely to form if tillage for weed control is limited to the time when weeds are visible.

Grain and grass respond to nitrogen. Clover may respond to sulfur and boron.

CAPABILITY UNIT IIIw-3

This capability unit consists of one very fine sandy loam of the Wolfeson series. It is a somewhat poorly drained, slowly permeable soil in depressions, drainageways, and gently sloping areas next to drainageways. Fertility is low. Surface runoff is very slow or ponded. There is little or no hazard of erosion. Root penetration is restricted by wetness and by the slowly permeable substratum, and spring tillage has to be delayed because of wetness. The annual precipitation ranges from 22 to 24 inches. The frost-free season is 90 days.

This soil is suited to spring grain and to clover and grass for hay and pasture. It is not suited to alfalfa or winter wheat unless the substratum is broken by deep plowing. Spring wheat, spring barley, oats, clover, and grass are the major crops grown. Most of the acreage is in a rotation consisting of grass and clover for 4 to 6 years, followed by spring grain for 1 or 2 years; but the soil can be used more intensively. Examples of suitable cropping systems are—

- Clover or a grass-clover mixture 2 or 3 years; then grain 4 to 6 years.
- Clover or a grass-clover mixture seeded with grain 1 year; then green manure 1 year; and spring grain 1 year.

This soil can be without a grass or legume cover during most winters. Returning all crop residues to the soil and growing grass and legumes in the rotation help to maintain or improve tilth. Depressions in which water stands can be shaped or drained. Deep subsoiling loosens the subsoil and promotes aeration and drainage. Grain and grass respond to nitrogen, and grain may respond to sulfur. Legumes may respond to sulfur and boron.

CAPABILITY UNIT IIIw-4

Only one soil is in this capability unit. It is a moderately permeable Wethey loamy sand, drained. This somewhat poorly drained soil occurs on bottom lands that are crossed by many old stream channels and are subject to overflow. Fertility is low, and the water-holding capacity is moderate. Root penetration is deep. Surface runoff is very slow, and there is little or no hazard of erosion except by stream cutting. The annual precipitation is 18 to 22 inches, and the average frost-free season is 100 days.

This soil is suited to spring grain and to grass and legumes for hay and pasture. Oats, grass, and legumes

are the main crops grown. Examples of suitable cropping systems are—

- Legumes or a grass-legume mixture seeded with grain 1 year; then green manure 1 year; and grain 1 year.
- Legumes or a grass-legume mixture 2 or 3 years; then grain 4 to 6 years.

This soil can be without a grass or legume cover most of the time if snags, gravel bars, and other obstacles are removed from stream channels to prevent flooding. Returning all crop residues to the soil and growing grass and legumes in the rotation help to maintain or improve tilth.

Grain and grass respond to nitrogen. Legumes respond to sulfur.

CAPABILITY UNIT IIIw-5

This capability unit consists of poorly drained, organic soils of the Semiahmoo series. These soils have been drained. They have a high to very high water-holding capacity and low fertility. Surface runoff is slow, and there is no erosion hazard. The annual precipitation ranges from 18 to 25 inches, and the frost-free season is about 100 days.

These soils are suited to grain and to clover and grass for hay and pasture. The major crop is oats. Examples of suitable cropping systems are—

- A perennial grass-clover mixture for hay and pasture.
- A grass-clover mixture or grass or clover 2 or 3 years; then oats 4 to 6 years.
- Oats annually. Nitrogen, phosphorus, potash, and magnesium must be applied.

Regulating the depth to the water table by the use of ditches and dams is important. These soils settle rapidly if the water table is too far below the surface, and crops are drowned if it is too near the surface.

Grain and grass crops respond to nitrogen.

CAPABILITY UNIT IVe-1

This capability unit consists of a well-drained, moderately permeable soil of the Athena series. This soil has a slope range of 30 to 40 percent. It is high in water-holding capacity and fertility. Root penetration is very deep. Surface runoff is rapid, and the hazard of erosion is severe. The annual precipitation is 15 to 18 inches. The frost-free season is about 140 days.

Wheat, barley, and oats, and grass and legumes for hay, pasture, or seed are the main crops grown. A suitable cropping system consists of alfalfa or an alfalfa-grass mixture 3 to 7 years, then grain 1 to 5 years.

This soil should have a grass or grass-legume cover most of the time. Grain can be grown annually for as much as 5 years following alfalfa and grass, provided erosion is controlled by seeding waterways to grass, returning all crop residues to the soil, tilling on the contour or across the slope, seeding fall grain early, and keeping the soil surface rough and cloddy during winter. In addition to these practices, stripcropping is needed on long slopes.

In years when snowfall is above average, this soil is covered by deep drifts that smother fall-seeded grain, permit weed invasion, and cause severe rill erosion or deep soil slips. These hazards can be reduced by leaving stubble on the hilltops and on the upper part of southern and western slopes or by planting windbreaks of trees and shrubs on hilltops. Grain and grass respond to nitrogen. Legumes respond to sulfur.

CAPABILITY UNIT IVe-2

This capability unit consists of well-drained, moderately to slowly permeable soils of the Dearyton, Larkin, and Naff series. These soils are low to high in fertility and moderate to very high in water-holding capacity. Root penetration is moderately deep to very deep. The slope range is 20 to 45 percent. In most areas surface runoff is medium to rapid, and the hazard of erosion is moderate to severe. The annual precipitation is 18 to 25 inches. The frost-free season is 105 to 140 days.

These soils are suited to wheat, barley, oats, and forage seed crops and to grass and legumes for hay and pasture. Wheat, barley, oats, and grass seed are the major crops grown. A suitable cropping system consists of legumes, a grass-legume mixture, or grass for seed 3 to 7 years, then grain 1 to 5 years.

These soils should have a grass or legume cover most of the time. Grain can be grown annually for as much as 5 years following grass and alfalfa, provided erosion is controlled by seeding waterways to grass, returning all crop residues to the soil, tilling on the contour or across the slope, seeding fall grain early, and keeping the soil surface rough and cloddy during winter. Field stripcropping and, if practical, diversion terraces, either singly or in combination with stripcropping, are needed on moderate and long slopes that lack a grass or legume cover.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if tillage for weed control is limited to the time when weeds are visible.

In some years when snowfall is above average, these soils are covered by deep drifts, which smother fall-seeded grain, permit weed invasion, and cause severe rill erosion or deep soil slips when the snow melts (fig. 10). These hazards can be reduced by leaving stubble on the hilltops and on the upper part of southern and western slopes or by planting windbreaks of trees or shrubs on hilltops.

Grass and grain respond to nitrogen. Legumes may respond to sulfur, boron, and phosphorus. In some areas wheat responds to sulfur. Crops on eroded soils need larger amounts of fertilizer than those on uneroded soils.

CAPABILITY UNIT IVe-3

This capability unit consists of well drained and moderately well drained, severely eroded soils of the Cedonia, Freeman, Garfield, Naff, and Nez Perce series. These soils have moderate to very slow permeability, low to medium fertility, and moderate to very high water-holding capacity. Root penetration is moderately deep to very deep. The slope range is 0 to 30 percent. Surface runoff is medium to rapid, and the hazard of further erosion is moderate to severe. The annual precipitation ranges from 18 to 23 inches, and the frost-free season from 125 to 140 days.

These soils are planted to wheat, barley, oats, and forage seed crops and to grass and legumes for hay and pasture.

Before a grain crop is grown, these soils should be kept in grass and legumes for several years in order to check erosion and protect lower-lying soils from runoff and deposition. After the second cycle of grass and legumes, grain can be grown safely on short slopes for 2 years, provided tillage is on the contour, waterways are seeded to grass, fall grain is seeded early in a rough, cloddy seedbed, furrows are turned uphill instead of downhill, and all

Figure 10.—**Snowdrifts on frozen ground, followed by rain and warm wind, caused the severe erosion and deep soil slips on Naff silt loam, 30 to 45 percent slopes, eroded.**

crop residues are returned to the soil. Field terraces, diversion terraces, or stripcropping, either singly or in combination, are needed for control of erosion if grain is grown on long slopes.

Chiseling these soils in fall when they are dry improves water intake, especially if straw or manure is applied at the same time and if trees, shrubs, alfalfa, or other deep-rooted plants are planted the following spring. Using spring grain or peas as a companion crop with new plantings of grass and legumes on these soils is not advisable.

Grass and grain respond to nitrogen. Legumes respond to sulfur and phosphorus and, in places, to molybdenum and boron. In some areas wheat responds to sulfur and phosphorus.

CAPABILITY UNIT IVe-4

This capability unit consists of well-drained soils of the Bernhill, Glenrose, Moscow, Schumacher, Spokane, and Tekoa series. Most of these soils are moderately deep to very deep. The Bernhill soil is moderately shallow. These soils have a gravelly surface layer or are underlain by bedrock. They have moderate to moderately rapid permeability, low to high fertility, and moderate to high water-holding capacity. The slope range is 0 to 30 percent. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe. The annual precipitation is 18 to 27 inches. The frost-free season is 90 to 135 days.

These soils are suited to wheat, barley, oats, forage seed crops, grass, and legumes. Wheat, barley, oats, and grass seed are the main crops grown. A suitable cropping system consists of legumes or a grass-legume mixture for hay or pasture, or grass for seed 4 to 6 years; then grain 2 or 3 years.

These soils can be without a grass or legume cover during about one-third of the winters without the hazard of excessive erosion, provided waterways are seeded to grass, all crop residues are returned to the soil, tillage is on the contour or across the slope, the furrow slice is turned uphill, and fall grain is seeded early in a rough, cloddy seedbed. Stripcropping, diversion terraces, and field terraces, either singly or in combination, are needed to control erosion on long slopes.

Grass and grain respond to nitrogen. Legumes respond to sulfur and boron and occasionally to phosphorus. Wheat shows some response to sulfur when large amounts of nitrogen are applied.

CAPABILITY UNIT IVe-5

This capability unit consists of well-drained and somewhat excessively drained soils of the Bong, Cheney, Clayton, Garrison, Hasseltine, Marble, and Springdale series. These soils have moderate or moderately rapid permeability. The water-holding capacity and fertility are low to medium. Root penetration is moderately deep or deep. The slope range is 0 to 20 percent. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate. The annual precipitation is 15 to 23 inches. The frost-free season is 110 to 170 days.

These soils are used for wheat, barley, and oats, grass and legumes, and grass seed. The Garrison soils under irrigation are suited to row crops, berries and orchard fruits, alfalfa, and grass for seed.

Under dryland farming, these soils can be without a grass or legume cover during one-half to two-thirds of the winters without the hazard of excessive erosion, provided waterways are seeded to grass, all crop residues are returned to the soil, and fall grain is seeded early. Many farmers use a cropping system of alfalfa and grass for hay and pasture or grass for seed 4 to 6 years, followed by grain 1 or 2 years.

Under irrigation, the Garrison soils that have slopes of as much as 5 percent can be without a grass or legume cover without the hazard of excessive erosion. The steeper Garrison soils should be in a grass or legume cover more than half the time. Grain and grass respond to nitrogen. Alfalfa may respond to sulfur and boron.

CAPABILITY UNIT IVe-6

This capability unit consists of well-drained and somewhat excessively drained soils of the Bonner and Hagen series. These soils are underlain by sandy or gravelly material at a depth of 10 to 36 inches. They are low in fertility and moderate in water-holding capacity.

Root penetration is moderately deep to deep. The slope range is 0 to 20 percent. Surface runoff is slow, and the hazard of water erosion is slight. On the Hagen soil, there is a moderate hazard of wind erosion. The annual precipitation ranges from 20 to 30 inches, and the frost-free season from 100 to 140 days.

These soils are planted to wheat and barley and to alfalfa and grass for hay and pasture. Yields are low. A cropping system commonly used on the Hagen soil consists of alfalfa or an alfalfa-grass mixture 4 to 8 years, then grain 1 year. On the Bonner soils, grain is grown for 1 or 2 years.

Many farmers grow grain for 2 years on the Bonner soils after plowing out a stand of grass and legumes. The second crop is grown to allow additional time for the old sod to decompose before an area is replanted to grass and legumes. Yields are generally much lower the second year than the first. Grain and grass respond to nitrogen and, in places, to phosphorus. Legumes have responded to surfur and boron.

CAPABILITY UNIT IVe–7

This capability unit consists of a well-drained, severely eroded, strongly calcareous soil of the Lance series. This soil occurs on the top of ridges and a little downslope from the top. It has moderately slow permeability, moderate water-holding capacity, and low fertility. Root penetration is deep. The slope range is 0 to 30 percent. Surface runoff is medium to rapid, and the hazard of erosion is severe. The annual precipitation ranges from 15 to 20 inches, and the frost-free season is about 140 days.

This soil is planted mainly to wheat, barley, oats, and forage seed crops and to grass and legumes for hay and pasture. Before grain is planted, this soil should be kept in grass or alfalfa and grass for several years to check erosion and to avoid spreading the strongly calcareous soil material over larger areas by tillage. Until there is a buildup of organic matter in the surface layer, grain should be grown no more than 1 year at a time. Field terraces, diversion terraces, or stripcropping, either singly or in combination, are necessary for control of erosion when grain is grown.

Grass and grain crops respond to large quantities of nitrogen and phosphorus. Legumes respond to sulfur and, in places, to boron.

CAPABILITY UNIT IVw–1

This capability unit consists of poorly drained, level and nearly level soils of the Bridgeson, Konner, and Peone series. These soils are saturated and ponded part of the growing season. They have moderate or slow permeability and medium or high fertility. The slope range is 0 to 5 percent. The annual precipitation is about 20 or 21 inches, and the frost-free season ranges from 90 to 100 days.

These soils are suited to spring wheat, spring barley, and oats, and to grass and clover for hay and pasture. Barley, oats, clover, and grass are the major crops grown. Examples of suitable cropping systems are—

- Clover or a grass-clover mixture seeded with or without spring grain 1 year; then green manure 1 year; and spring grain 1 year.
- Clover or grass or a grass-clover mixture 2 or 3 years; then spring grain 6 to 10 years.

These soils can be left without protection of a grass or legume cover during most winters, provided all crop residues are returned to the soil and stream channels are kept clear by removing snags, gravel bars, and other obstacles. Growing grass and legumes in rotation helps to maintain or improve tilth. Drainage can be provided by tile or open ditches if outlets are available.

Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if these soils are tilled for weed control only when weeds are visible.

Grass and grain respond to nitrogen; legumes respond to sulfur and, in places, to boron.

CAPABILITY UNIT IVw–2

This capability unit consists of a somewhat poorly drained, nearly level soil of the Cocolalla series. This soil occurs in basins and potholes and is saturated for 2 or 3 months early in spring. It is very high in water-holding capacity and high in fertility. Surface runoff is very slow or slow. There is little or no hazard of erosion. The annual precipitation is 15 to 18 inches, and the frost-free season is about 100 days.

This soil is suited to spring barley and oats and to clover and grass for hay and pasture. Oats, clover, and grass are the major crops grown. Examples of suitable cropping systems are—

- Clover or a clover-grass mixture seeded with or without spring barley 1 year; then green manure 1 year; and oats or barley 1 year.
- Clover or a clover-grass mixture 2 or 3 years; then spring grain 4 to 6 years.

This soil can be used without a grass or legume cover during most winters if all crop residues are returned to the soil and if the drainage system is kept open. Chiseling may be needed every few years to break tillage pans. A pan is less likely to form if this soil is tilled for weed control only when weeds are visible. Growing grass and legumes in rotation help to maintain or improve tilth.

Grass and grain crops respond to nitrogen. Legumes may respond to sulfur and boron.

CAPABILITY UNIT IVw–3

The only soil in this capability unit is Emdent silt loam that has a slope range of 0 to 5 percent. It is a somewhat poorly drained, alkaline soil in basins and potholes of the channeled scablands. This soil has moderate permeability and high fertility. Surface runoff is very slow, and there is little or no hazard of erosion. The annual precipitation ranges from 15 to 18 inches. The frost-free season is about 130 days.

This soil is suited to barley, to alkali-tolerant grass for seed, and to grass and legumes. It is used mainly for hay and pasture.

If outlets are available for drainage, the application of gypsum or sulfur aids in leaching the alkaline elements from the soil. After drainage and leaching, a wider variety of crops can be grown and increased yields can be obtained. Growing grass and legumes in rotation helps to maintain or improve tilth.

Grain and grass respond to nitrogen. Legumes respond to sulfur and phosphorus and, possibly, to boron.

CAPABILITY UNIT Vw-1

This capability unit consists of poorly drained and very poorly drained, level soils of the Cocolalla, Semiahmoo, and Wethey series. These soils are used mainly as range. They are in the Wet Meadow range site and are discussed in the range management section of this report.

CAPABILITY UNIT VIe-1

This capability unit consists of soils of the Athena, Bong, Glenrose, Lance, Phoebe, and Schumacher series. These soils have a slope range of 20 to 70 percent.

All but two of the soils are in the North Exposure range site or Shallow range site and are discussed in the range management section. The Lance soil and Schumacher gravelly silt loam, 30 to 55 percent slopes, eroded, are not used as range. They are suitable for reseeding to perennial grasses.

CAPABILITY UNIT VIe-2

This capability unit consists of soils of the Bernhill, Bonner, Dragoon, Hesseltine, Lakesol, Moscow, Spokane, Springdale, Tekoa, and Vassar series. These soils are gravelly, nearly level to steep, or moderately shallow and shallow and are used mainly as woodland or for hay and limited grazing. They are discussed in the woodland section of this report.

CAPABILITY UNIT VIs-1

This capability unit consists of coarse-textured, stony, very stony, or very rocky soils of the Bernhill, Dragoon, Eloika, Hagen, Hesseltine, Marble, and Spokane series. These soils are used mainly as woodland and are discussed in the woodland section of this report.

CAPABILITY UNIT VIs-2

In this capability unit are stony, very stony, and very rocky soils of the Brickel, Cheney, Garrison, and Glenrose series. These soils are unsuited to cultivation. The Cheney, Garrison, and Glenrose soils are used mainly as range and are discussed in the range management section of this report. The Brickel soil is suited to grazing but is not in a range site because it is used only for recreation, watershed, and wildlife purposes.

CAPABILITY UNIT VIIe-1

This capability unit consists of moderately shallow and steep or very steep soils of the Athena, Palouse, and Spokane series. .These soils are unsuited to cultivation. They are used mainly as range or woodland and are discussed in the range or woodland section of this report.

CAPABILITY UNIT VIIs-1

This capability unit consists of coarse-textured, stony, cobbly, gravelly, or very rocky soils of the Bernhill, Eloika, Marble, Speigle, Spokane, and Springdale series. These soils are used mainly as woodland and for limited grazing and are discussed in the woodland section of this report.

CAPABILITY UNIT VIIs-2

This capability unit consists of very rocky soils of several series, predominantly Hesseltine. These soils have a slope range of 0 to 70 percent. They are used for grazing and as woodland.

CAPABILITY UNIT VIIIw-1

This capability unit consists of Fresh water marsh and Riverwash, which have little or no agricultural value.

CAPABILITY UNIT VIIIs-1

This capability unit consists of Rock outcrop, which is useful only for wildlife, watershed, recreation, and other nonfarm purposes.

Estimated yields

Table 2 gives estimates of yields on dryfarmed soils in capability classes II, III, and IV, under improved management and under average management. The figures are based principally on information obtained from farmers and other agricultural workers at the time this survey was made.

Several important limitations must be kept in mind in using the table: (1) The figures are estimates. They are sufficiently reliable, however, to be of much value. (2) The figures represent averages that can be expected over a period of years; the yield in any one year may be considerably higher or lower than the average. In Spokane County, rains that come late in May and early in June generally result in high yields. On the other hand, lack of rain in May or June results in yields much below the average. (3) Past management of a soil influences its immediate response to management. (4) Development of new crop varieties and improvement in management practices affect yields.

The figures in columns A are estimates of yields that can be obtained by farmers who use good management practices such as those suggested in the descriptions of capability units. The figures in columns B are estimates of yields that can be obtained under average management, by farmers who, for example, do not use a good cropping system, do not use the best tillage methods, or do not apply optimum amounts of fertilizer.

Range [2]

Approximately 105,000 acres in Spokane County, or 14 percent of the acreage, is used as range.

According to a State Tax Commission report, approximately 18,500 beef cattle, 15,500 dairy cattle, 2,700 sheep, and 1,300 horses grazed native forage in the county during at least part of the grazing season in 1959.

Kind, extent, and use of range

The most productive range areas in the county are along streams and in depressions in the channeled scablands in the southwestern part of the county; on the margins of lakes and along streams that are tributaries of the Spokane River; and in depressions in the southwestern corner of the county. These areas of alkali soils, bottom land, and wet meadows are comparatively small in extent but are important sources of green forage for summer and fall grazing. They are grazed about equally by dairy and beef cattle.

Next in production of forage are the grassland plains and terraces of the Spokane Valley, the scattered grassland buttes in the southwestern part of the county, and the nonwooded plains and slopes of the channeled scab-

[2] ALFRED E. YOUNG, range conservationist, Soil Conservation Service, assisted in preparing this subsection.

lands in the southwestern part of the county. All of the grasslands are grazed mainly by beef cattle in spring, summer, and fall. Horses and dairy cattle graze some parts periodically.

The ponderosa pine woodlands cover extensive areas both north and south of the city of Spokane. They produce considerably less forage than the open grasslands, partly because of invading weeds and thick stands of ponderosa pine, both of which result from fire, overgrazing, and improper woodland management.

Most of the woodland south of Spokane is grazed mainly by beef cattle in spring, summer, and fall. Appreciable numbers of dairy cattle and horses graze some parts periodically. In contrast, most of the woodland north of Spokane is not grazed. Urban development, highways, industries, power transmission lines, and railroads limit the use of this land for grazing. Many rural homes have pleasure horses or family cows that graze within fenced areas of less than 40 acres.

Range sites and condition classes

Grouping soils according to range sites and determining the condition of the sites are important steps in range management. All soils within the same range site produce about the same kind and amount of vegetation when in excellent condition, but different range sites may differ greatly in their potential for production of forage. For example, a range site made up of deep soils generally produces more forage than one made up of shallow soils within the same climatic zone.

The condition of a range site is determined by comparing the present vegetation with the potential native vegetation. The condition is *excellent* if 75 to 100 percent of the present vegetation is of the same composition as the potential native vegetation; it is *good* if the percentage is 50 to 75; *fair* if the percentage is 25 to 50; and *poor* if the percentage is less than 25. In figure 11, range in fair condition is compared with range in good condition on the same soil and in the same range site.

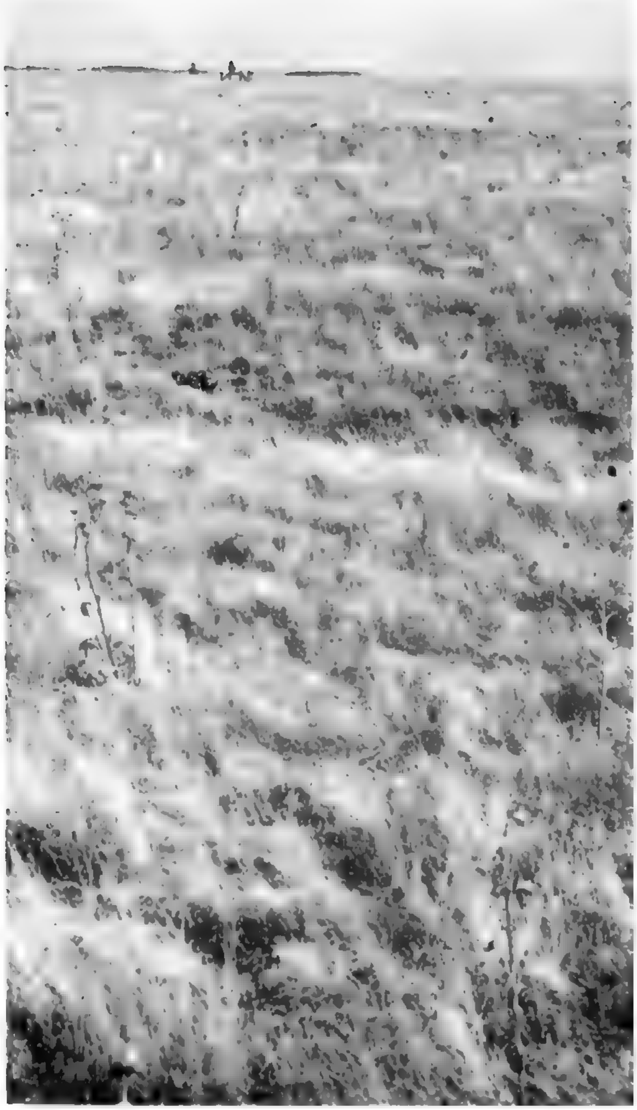


Figure 11.—At left is range in fair condition on Cheney stony silt loam, 0 to 20 percent slopes, in the Shallow range site; at right, on the same soil and in the same range site, is range in good condition.

TABLE 2.—*Estimated average yields per acre of common*

[Estimates of yields are given only for soils in capability classes II, III, and IV. If no estimate is given, the soil is not suited to the crop practices; in columns B are estimates of yields that

Soil	Winter wheat		Spring wheat		Winter barley	
	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Athena silt loam, 0 to 5 percent slopes	50	35	40	30	1.3	1.0
Athena silt loam, 5 to 30 percent slopes	45	30	35	25	1.0	.8
Athena silt loam, 30 to 55 percent slopes	40	25	30	20	1.0	.8
Bernhill silt loam, 0 to 20 percent slopes	50	40	40	30	1.1	.8
Bernhill silt loam, 20 to 30 percent slopes	45	35	35	25	1.0	.7
Bernhill gravelly silt loam, 0 to 20 percent slopes	40	30	30	20	.8	.6
Bernhill silt loam, moderately shallow, 0 to 20 percent slopes	40	30	30	20	1.0	.8
Bernhill soils:						
Bernhill silt loam, moderately shallow	35	25	25	18	.8	.6
Bong and Phoebe fine sandy loams, 0 to 8 percent slopes:						
Phoebe	30	25	25	20	.6	.5
Bong	25	20	22	18	.5	.4
Bong and Phoebe coarse sandy loams, 0 to 20 percent slopes:						
Phoebe	40	30	35	30	.8	.6
Bong	35	30	30	25	.7	.5
Bong and Phoebe loamy sands, 0 to 20 percent slopes:						
Phoebe	40	30	35	30	.8	.6
Bong	35	30	30	25	.7	.5
Bong coarse sandy loam, 0 to 8 percent slopes	20	15	20	15	.4	.3
Bonner silt loam, 0 to 8 percent slopes	20	15	20	15	.5	.4
Bonner loam, 0 to 20 percent slopes	25	15	20	12	.5	.4
Bonner fine sandy loam, 0 to 20 percent slopes	20	15	20	12	.5	.4
Bridgeson silt loam, drained	------	------	45	35	------	------
Bridgeson silt loam	------	------	35	25	------	------
Caldwell silt loam	60	50	50	40	1.5	1.2
Cedonia silt loam, 0 to 5 percent slopes	50	40	45	35	1.5	1.2
Cedonia silt loam, 5 to 20 percent slopes	45	35	40	30	1.2	1.0
Cedonia silt loam, 20 to 30 percent slopes, severely eroded	35	25	25	20	1.0	.8
Cheney and Uhlig silt loams, 0 to 8 percent slopes:						
Uhlig	45	35	40	30	.9	.7
Cheney	30	20	25	18	.8	.5
Cheney gravelly silt loam, 0 to 8 percent slopes	20	15	18	13	.6	.4
Clayton fine sandy loam, 0 to 5 percent slopes	50	40	35	30	1.2	1.0
Clayton loam, 0 to 5 percent slopes	50	40	35	30	1.2	1.0
Clayton fine sandy loam, 5 to 20 percent slopes	45	35	35	30	1.2	1.0
Clayton loam, 5 to 20 percent slopes	45	35	35	30	1.2	1.0
Clayton sandy loam, 0 to 8 percent slopes	20	15	18	13	.5	.3
Cocolalla silty clay loam, drained	------	------	------	------	------	------
Dearyton silt loam, 0 to 5 percent slopes	50	40	40	30	1.5	1.0
Dearyton silt loam, 5 to 20 percent slopes	50	40	40	30	1.5	1.0
Dearyton silt loam, thin solum variant, 0 to 20 percent slopes	45	35	35	25	1.1	.8
Dearyton silt loam, 20 to 40 percent slopes	45	35	35	25	1.1	.8
Dragoon silt loam, 0 to 30 percent slopes	40	30	30	20	1.3	1.0
Eloika silt loam, 0 to 20 percent slopes	40	30	30	20	1.0	.8
Emdent silt loam	------	------	------	------	------	------
Freeman silt loam, 5 to 20 percent slopes	50	40	40	30	1.5	1.0
Freeman silt loam, 5 to 20 percent slopes, severely eroded	40	30	35	25	1.3	.9
Freeman silt loam, 20 to 30 percent slopes, severely eroded	35	25	30	20	1.0	.8
Garfield silty clay loam, 0 to 30 percent slopes, severely eroded	35	25	30	20	1.3	1.0
Garrison gravelly loam, 0 to 5 percent slopes	30	20	30	20	.8	.5
Garrison gravelly loam, 5 to 20 percent slopes	30	20	30	20	.8	.5
Garrison very gravelly loam, 0 to 8 percent slopes	25	20	------	------	------	------
Glenrose silt loam, 0 to 5 percent slopes	60	50	50	40	1.3	1.0
Glenrose silt loam, 5 to 20 percent slopes	60	50	50	40	1.3	1.0
Glenrose silt loam, 20 to 30 percent slopes	50	40	40	30	1.0	.9
Glenrose gravelly silt loam, 5 to 20 percent slopes	35	25	30	20	1.0	.9
Green Bluff silt loam, 0 to 5 percent slopes	60	45	50	35	1.1	.8
Green Bluff silt loam, 5 to 20 percent slopes	60	45	50	35	1.1	.8
Hagen sandy loam, 0 to 20 percent slopes	20	15	------	------	.8	.5
Hardesty silt loam, 0 to 5 percent slopes	35	30	30	20	1.0	.8
Hardesty silt loam, moderately shallow, 0 to 5 percent slopes	35	30	30	20	1.0	.8
Hesseltine silt loam, 0 to 10 percent slopes	20	15	20	15	.6	.4
Hesseltine silt loam, moderately deep, 0 to 8 percent slopes	30	20	25	20	.6	.4
Hesseltine gravelly silt loam, 0 to 10 percent slopes	20	15	20	15	.6	.4

dryfarmed crops under two levels of management

or the crop is not grown to a significant extent. In columns A are estimates of yields that can be obtained under improved management
can be obtained under average management practices]

Spring barley		Oats		Dry field peas		Lentils		Alfalfa hay		Alfalfa and grass hay		Clover hay		Clover and grass hay	
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Tons	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
1. 2	0. 9	1. 2	0. 9	1, 200	1, 000	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
1. 0	. 8	1. 0	. 8	1, 100	900	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
1. 0	. 8	1. 0	. 8	------	------	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
1. 0	. 8	1. 0	. 8	------	------	------	------	2. 8	2. 0	3. 0	2. 0	------	------	------	------
. 8	. 6	. 8	. 6	------	------	------	------	2. 8	2. 0	2. 5	2. 0	------	------	------	------
. 6	. 5	. 6	. 5	------	------	------	------	2. 0	1. 3	2. 0	1. 3	------	------	------	------
. 8	. 5	. 8	. 5	------	------	------	------	2. 0	1. 5	2. 3	1. 5	------	------	------	------
. 6	. 4	. 6	. 4	------	------	------	------	1. 8	1. 4	2. 2	1. 4	------	------	------	------
. 6	. 5	. 5	. 4	------	------	------	------	1. 2	. 9	1. 3	1. 1	------	------	------	------
. 5	. 4	. 5	. 4	------	------	------	------	1. 0	. 8	1. 2	1. 0	------	------	------	------
. 7	. 5	. 7	. 5	------	------	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
. 7	. 5	. 6	. 4	------	------	------	------	1. 8	1. 2	1. 8	1. 2	------	------	------	------
. 7	. 5	. 7	. 5	------	------	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
. 7	. 5	. 6	. 5	------	------	------	------	1. 8	1. 2	1. 8	1. 2	------	------	------	------
. 4	. 3	. 4	. 3	------	------	------	------	. 8	. 6	1. 0	. 8	------	------	------	------
. 4	. 3	. 4	. 3	------	------	------	------	1. 0	. 5	1. 0	. 5	------	------	------	------
------	------	------	------	------	------	------	------	1. 5	. 8	1. 5	. 8	------	------	------	------
------	------	------	------	------	------	------	------	1. 5	. 8	1. 5	. 8	------	------	------	------
2. 0	1. 5	1. 5	1. 0	------	------	------	------	------	------	------	------	1. 0	. 8	2. 0	1. 5
1. 5	1. 0	1. 5	1. 0	------	------	------	------	------	------	------	------	1. 0	. 8	2. 0	1. 5
1. 5	1. 2	1. 5	1. 2	------	------	------	------	3. 0	2. 0	3. 0	2. 0	3. 0	2. 0	3. 0	2. 0
1. 3	. 8	1. 2	1. 0	1, 400	1, 000	500	400	3. 0	1. 5	3. 0	1. 5	------	------	------	------
1. 2	. 7	1. 0	. 8	1, 200	900	450	350	3. 0	1. 5	3. 0	1. 5	------	------	------	------
1. 0	. 6	. 9	. 7	1, 000	800	------	------	1. 5	1. 0	1. 5	1. 2	------	------	------	------
. 9	. 7	. 9	. 7	1, 200	1, 000	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
. 8	. 5	. 8	. 5	------	------	------	------	1. 0	. 8	1. 3	1. 0	------	------	------	------
. 5	. 3	. 4	. 2	------	------	------	------	. 8	. 5	1. 0	. 8	------	------	------	------
1. 0	. 8	1. 0	. 8	------	------	------	------	3. 5	2. 5	3. 5	3. 0	------	------	------	------
1. 0	. 8	1. 0	. 8	------	------	------	------	3. 5	2. 5	3. 5	3. 0	------	------	------	------
. 8	. 6	. 8	. 6	------	------	------	------	3. 5	2. 5	3. 5	3. 0	------	------	------	------
. 8	. 6	. 8	. 6	------	------	------	------	3. 5	2. 5	3. 5	2. 5	------	------	------	------
. 4	. 2	------	------	------	------	------	------	1. 0	. 8	1. 0	. 8	------	------	------	------
1. 5	1. 0	1. 5	1. 0	------	------	------	------	3. 0	2. 0	3. 0	2. 0	------	------	------	------
1. 0	. 8	1. 0	. 8	1, 400	1, 000	700	550	2. 5	1. 5	3. 0	2. 0	1. 5	1. 0	2. 0	1. 5
1. 0	. 8	1. 0	. 8	------	------	------	------	2. 5	1. 5	3. 0	2. 0	------	------	------	------
. 8	. 5	1. 0	. 8	1, 400	1, 000	700	500	2. 5	1. 5	3. 0	2. 0	------	------	------	------
. 8	. 5	1. 0	. 8	------	------	------	------	2. 2	1. 0	2. 2	1. 0	------	------	------	------
1. 0	. 8	. 9	. 7	------	------	------	------	1. 0	. 8	1. 0	. 8	------	------	------	------
. 7	. 5	. 7	. 5	------	------	------	------	2. 0	1. 5	2. 0	1. 5	------	------	------	------
. 5	. 3	. 5	. 3	------	------	------	------	1. 5	1. 0	1. 5	1. 0	------	------	------	------
1. 0	. 8	1. 5	1. 0	1, 400	1, 000	700	500	1. 5	. 8	2. 0	1. 0	2. 0	1. 0	2. 0	1. 0
. 9	. 7	. 9	. 7	------	------	------	------	1. 0	. 6	1. 5	. 9	1. 5	. 9	1. 5	. 9
. 8	. 5	. 8	. 5	------	------	------	------	. 8	. 5	1. 3	. 8	------	------	------	------
. 9	. 7	. 9	. 7	------	------	------	------	1. 0	. 5	1. 3	. 8	------	------	------	------
. 6	. 4	. 6	. 4	------	------	------	------	. 8	. 5	1. 0	. 8	------	------	------	------
. 6	. 4	. 5	. 4	------	------	------	------	. 8	. 5	1. 0	. 8	------	------	------	------
. 6	. 4	. 6	. 4	------	------	------	------	. 8	. 5	1. 0	. 8	------	------	------	------
1. 1	. 9	1. 0	. 8	1, 600	1, 200	700	500	3. 0	2. 5	3. 0	2. 5	------	------	------	------
1. 0	. 8	1. 0	. 8	1, 600	1, 200	700	500	2. 8	2. 2	3. 0	2. 5	------	------	------	------
. 8	. 6	. 8	. 6	------	------	------	------	1. 5	1. 2	2. 5	2. 0	------	------	------	------
. 9	. 7	. 8	. 6	------	------	------	------	1. 3	1. 0	1. 5	1. 2	------	------	------	------
1. 1	. 9	1. 0	. 8	1, 600	1, 200	700	500	3. 0	1. 5	3. 0	1. 5	------	------	------	------
1. 0	. 8	1. 0	. 8	1, 600	1, 200	700	500	2. 8	1. 2	3. 0	1. 5	------	------	------	------
------	------	------	------	------	------	------	------	1. 0	. 8	1. 0	. 8	------	------	------	------
. 8	. 5	. 8	. 5	------	------	------	------	1. 0	. 8	1. 5	1. 2	------	------	------	------
. 8	. 5	. 8	. 5	------	------	------	------	1. 0	. 8	1. 5	1. 2	------	------	------	------
. 5	. 4	------	------	------	------	------	------	. 8	. 6	1. 0	. 8	------	------	------	------
. 6	. 5	------	------	------	------	------	------	1. 0	. 8	1. 3	1. 0	------	------	------	------
. 5	. 4	------	------	------	------	------	------	. 8	. 6	1. 0	. 8	------	------	------	------

TABLE 2.—*Estimated average yields per acre of common*

Soil	Winter wheat		Spring wheat		Winter barley	
	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Konner silty clay loam	------	------	35	25	------	------
Konner silty clay loam, drained	------	------	45	35	------	------
Lakesol silt loam, 0 to 20 percent slopes	40	30	30	20	1.3	1.0
Laketon silt loam, 0 to 5 percent slopes	50	40	40	30	1.2	1.0
Laketon fine sandy loam, 0 to 5 percent slopes	50	40	30	20	1.2	1.0
Laketon silt loam, 5 to 20 percent slopes	50	40	40	30	1.2	1.0
Lance silt loam, 0 to 30 percent slopes	40	30	30	20	.8	.6
Lance silt loam, 0 to 30 percent slopes, severely eroded	25	20	20	15	.6	.4
Larkin silt loam, 0 to 5 percent slopes, eroded	60	50	50	40	1.3	1.0
Larkin silt loam, 5 to 20 percent slopes, eroded	55	45	45	35	1.2	.9
Larkin silt loam, 20 to 45 percent slopes, eroded	50	40	40	30	1.1	.8
Latah silt loam	------	------	45	35	------	------
Marble sandy loam, 0 to 8 percent slopes	20	15	------	------	.5	.3
Mondovi silt loam	60	50	40	30	------	------
Moscow silt loam, 0 to 30 percent slopes	35	30	30	20	1.0	.5
Naff silt loam, 0 to 5 percent slopes	60	45	40	35	1.5	1.0
Naff silt loam, 0 to 5 percent slopes, eroded	55	40	35	30	1.0	.7
Naff silt loam, 5 to 30 percent slopes	60	45	40	35	1.5	1.0
Naff silt loam, 5 to 30 percent slopes, eroded	55	40	35	30	1.0	.7
Naff silt loam, 30 to 45 percent slopes, eroded	50	35	40	30	.9	.6
Naff silt loam, 0 to 30 percent slopes, severely eroded	40	25	30	25	1.0	.7
Narcisse silt loam, 0 to 5 percent slopes	40	30	40	30	1.3	1.0
Nez Perce silt loam, 0 to 5 percent slopes	60	50	50	40	1.5	1.2
Nez Perce silt loam, 5 to 20 percent slopes	55	45	45	35	1.3	1.1
Nez Perce silt loam, 5 to 20 percent slopes, severely eroded	40	30	35	25	1.2	1.0
Palouse silt loam, moderately shallow, 0 to 20 percent slopes	40	30	35	30	1.2	1.0
Palouse silt loam, moderately shallow, 20 to 30 percent slopes	35	25	30	25	1.0	.8
Palouse silt loam, 5 to 30 percent slopes, eroded	60	50	50	40	1.5	1.0
Peone silt loam, drained, 0 to 5 percent slopes	40	30	40	30	1.3	1.0
Peone silt loam, 0 to 5 percent slopes	------	------	35	25	------	------
Phoebe sandy loam, 0 to 5 percent slopes	50	40	40	30	1.0	.8
Phoebe sandy loam, 5 to 20 percent slopes	50	40	40	30	1.0	.8
Reardan silt loam, 0 to 5 percent slopes	45	35	35	25	1.0	.8
Reardan silt loam, 5 to 20 percent slopes	45	35	35	25	1.0	.8
Reardan silt loam, 5 to 20 percent slopes, eroded	40	30	30	25	1.0	.8
Reardan silt loam, 20 to 30 percent slopes, eroded	40	30	30	25	1.0	.8
Schumacher silt loam, 0 to 20 percent slopes	50	40	45	35	1.1	.9
Schumacher silt loam, 0 to 20 percent slopes, eroded	45	35	35	30	.9	.7
Schumacher silt loam, 20 to 30 percent slopes	50	40	40	30	.9	.7
Schumacher silt loam, 20 to 30 percent slopes, eroded	45	35	35	25	.8	.6
Schumacher gravelly silt loam, 5 to 30 percent slopes	35	25	30	20	.7	.5
Schumacher gravelly silt loam, 5 to 30 percent slopes, eroded	35	25	30	20	.7	.5
Semiahmoo muck, drained	------	------	------	------	------	------
Semiahmoo muck, moderately shallow, drained	------	------	------	------	------	------
Snow silt loam, 0 to 5 percent slopes:						
On terraces and foot slopes	65	55	60	50	2.0	1.5
On Peone Prairie	60	50	45	30	1.1	.9
Snow silt loam, 5 to 30 percent slopes:						
On terraces and foot slopes	65	55	60	50	2.0	1.5
On Peone Prairie	60	50	45	30	1.1	.8
Spokane loam, 0 to 30 percent slopes	35	30	30	25	1.0	.8
Springdale gravelly sandy loam, deep, 0 to 20 percent slopes	25	15	20	15	.5	.4
Tekoa gravelly silt loam, 5 to 20 percent slopes	30	20	25	20	.8	.6
Uhlig silt loam, 0 to 5 percent slopes:						
18 to 21 inches of rainfall	60	50	50	40	1.1	.8
15 to 18 inches of rainfall	45	35	40	30	.9	.7
Uhlig silt loam, 5 to 20 percent slopes:						
18 to 21 inches of rainfall	60	50	50	40	1.1	.8
15 to 18 inches of rainfall	45	35	40	30	.9	.7
Uhlig silt loam, moderately shallow, 5 to 30 percent slopes	45	35	35	25	.8	.6
Wethey loamy sand, drained	------	------	35	25	------	------
Wolfeson very fine sandy loam	------	------	35	25	------	------

dryfarmed crops under two levels of management—Continued

Spring barley		Oats		Dry field peas		Lentils		Alfalfa hay		Alfalfa and grass hay		Clover hay		Clover and grass hay	
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Tons	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
1.0	.8	1.0	.8	--	--	--	--	--	--	--	--	1.0	.8	2.0	1.5
1.5	1.2	1.5	1.2	--	--	--	--	--	--	--	--	2.0	1.5	2.0	1.5
1.0	.8	.9	.7	--	--	--	--	1.0	.8	1.0	.8	--	--	--	--
1.0	.8	1.0	.8	--	--	--	--	3.0	2.0	4.0	3.0	--	--	--	--
.8	.6	.8	.6	--	--	--	--	3.0	2.0	4.0	3.0	--	--	--	--
.8	.5	.8	.5	--	--	--	--	3.0	2.0	4.0	3.0	--	--	--	--
.5	.4	.5	.4	--	--	--	--	1.0	.8	1.0	.8	--	--	--	--
.4	.3	.4	.3	--	--	--	--	.8	.5	1.0	.8	--	--	--	--
1.0	.8	.9	.7	1,700	1,200	800	500	3.0	2.0	3.0	2.0	--	--	--	--
.9	.7	.9	.7	1,700	1,200	800	500	2.8	2.0	3.0	2.0	--	--	--	--
.8	.6	.8	.6	--	--	--	--	1.5	1.2	2.5	2.0	--	--	--	--
1.0	.6	1.5	1.0	--	--	--	--	--	--	--	--	1.0	.8	2.0	1.6
--	--	--	--	--	--	--	--	1.5	.8	1.5	.8	--	--	--	--
1.5	1.0	1.3	1.0	1,200	1,000	--	--	2.0	1.5	3.0	2.0	2.0	1.5	3.0	2.5
.8	.5	.6	.4	--	--	--	--	2.5	1.5	2.5	1.5	--	--	--	--
1.0	.8	1.2	.8	1,700	1,200	800	500	3.0	1.8	3.0	1.8	--	--	--	--
1.0	.7	.8	.6	1,400	1,000	650	400	3.0	1.8	3.0	1.8	--	--	--	--
1.0	.8	.9	.7	1,700	1,200	800	500	3.0	1.8	3.0	1.8	--	--	--	--
1.0	.7	.8	.6	1,400	1,000	650	400	2.5	1.7	2.5	1.7	--	--	--	--
.8	.6	.8	.6	--	--	--	--	2.0	1.5	2.5	2.0	--	--	--	--
.7	.5	.7	.5	--	--	--	--	1.5	1.2	2.0	1.5	--	--	--	--
1.3	1.0	1.3	1.0	--	--	--	--	2.0	1.5	2.0	1.5	--	--	--	--
1.1	.9	1.6	1.4	1,600	1,200	700	550	3.0	1.5	3.0	1.5	--	--	--	--
1.0	.8	1.5	1.3	1,500	1,100	600	500	3.0	1.5	3.0	1.5	--	--	--	--
.9	.6	.9	.7	--	--	--	--	1.5	1.0	2.5	1.5	--	--	--	--
1.0	.8	1.0	.8	1,100	800	500	400	1.8	1.5	2.0	1.5	--	--	--	--
.9	.7	.9	.7	1,100	800	500	400	1.5	1.0	1.5	1.0	--	--	--	--
1.0	.8	1.5	1.3	1,700	1,200	650	450	2.5	2.0	2.5	2.0	--	--	--	--
1.3	1.0	1.3	1.0	--	--	--	--	1.5	1.0	1.5	1.0	2.0	1.5	2.0	1.5
1.3	1.0	1.3	1.0	--	--	--	--	--	--	--	--	2.0	1.5	2.0	1.5
.8	.5	.8	.5	--	--	--	--	2.5	2.0	3.0	2.0	--	--	--	--
.8	.5	.8	.5	--	--	--	--	2.5	2.0	3.0	2.0	--	--	--	--
1.0	.8	1.0	.8	1,200	800	--	--	1.0	.8	1.5	1.0	--	--	--	--
1.0	.8	1.0	.8	1,200	800	--	--	1.0	.8	1.3	1.0	--	--	--	--
1.0	.8	1.0	.8	--	--	--	--	--	--	--	--	--	--	--	--
1.0	.8	.9	.8	--	--	--	--	1.0	.8	1.0	.8	--	--	--	--
1.0	.8	1.0	.8	1,400	1,000	600	450	2.8	2.0	3.0	2.5	--	--	--	--
.9	.7	.9	.7	1,200	800	550	400	2.0	1.5	2.5	2.0	--	--	--	--
.8	.6	.8	.6	1,400	1,000	600	450	1.5	1.0	2.0	1.5	--	--	--	--
.8	.6	.8	.6	--	--	--	--	1.5	1.0	2.0	1.5	--	--	--	--
.7	.5	.8	.6	--	--	--	--	1.3	1.0	1.5	1.1	--	--	--	--
.7	.5	.8	.6	--	--	--	--	1.3	1.0	1.5	1.1	--	--	--	--
--	--	2.0	1.5	--	--	--	--	--	--	--	--	2.5	2.0	2.5	2.0
--	--	2.0	1.5	--	--	--	--	--	--	--	--	2.5	2.0	2.5	2.0
1.5	1.0	1.5	1.0	1,700	1,200	700	600	3.0	2.2	3.0	2.2	--	--	--	--
1.1	.9	1.0	.8	1,700	1,200	700	600	3.0	2.0	3.0	2.0	--	--	--	--
1.5	1.0	1.5	1.0	1,800	1,400	800	650	3.0	2.2	3.0	2.2	--	--	--	--
1.0	.8	1.0	.8	1,700	1,200	700	500	2.8	2.0	3.0	2.0	--	--	--	--
.8	.6	1.0	.8	--	--	--	--	1.2	.8	1.5	1.0	--	--	--	--
.5	.4	.5	.4	--	--	--	--	1.5	1.0	1.5	1.0	--	--	--	--
.8	.6	.6	.4	--	--	--	--	1.3	1.0	1.5	1.1	--	--	--	--
1.1	.8	1.0	.8	1,800	1,400	700	500	3.0	2.0	3.0	2.0	--	--	--	--
.9	.7	.9	.7	1,200	1,000	--	--	2.0	1.5	2.0	1.5	--	--	--	--
1.0	.8	1.0	.8	1,800	1,400	700	500	2.8	2.0	3.0	2.0	--	--	--	--
.9	.7	.9	.7	1,200	1,000	--	--	1.8	1.5	1.8	1.5	--	--	--	--
.8	.6	.8	.6	1,500	1,000	500	300	1.0	.8	1.5	1.0	--	--	--	--
.8	.6	.8	.6	--	--	--	--	1.0	.8	1.5	1.0	1.5	1.0	3.0	2.0
1.2	.8	1.0	.6	--	--	--	--	--	--	--	--	1.5	1.0	3.0	2.0

Six range sites are recognized in Spokane County. Those soils that are used principally for crops or as woodland have not been given a range site classification. For information about the grazing of woodland areas, see the subsection "Woodland."

In the descriptions of the six range sites, the important forage plants, the total annual herbage yield, and related information are given. The yields were determined from field estimates and indicate the approximate potential productivity of the range site. The list that follows contains the common and scientific names of the range plants, the understory plants, and the principal trees mentioned in this section and in the woodland section.

COMMON AND SCIENTIFIC NAMES OF PLANTS

Common name	Scientific name
Alder	*Alnus spp.*
Alkali bluegrass	*Poa juncifolia*
Alkali cordgrass	*Spartina gracilis*
Alumroot	*Heuchera spp.*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Aspen	*Populus tremuloides*
Astragalus	*Astragalus spp.*
Basin wildrye	*Elymus cinereus*
Bearberry (kinnikinnick)	*Arctostaphylos uva-ursi*
Beargrass	*Xerophyllum spp.*
Birch	*Betula spp.*
Biscuitroot	*Lomatium spp.*
Bitterroot	*Lewisia rediviva*
Bluebunch wheatgrass	*Agropyron spicatum*
Blue camas	*Camassia caerulea*
Blue-eyed-grass	*Sisyrinchium spp.*
Bottlebrush squirreltail	*Sitanion hystrix*
Buckwheat	*Eriogonum spp.*
Bullthistle	*Cirsium vulgare*
Buttercup	*Ranunculus spp.*
Cheatgrass	*Bromus tectorum*
Chokecherry	*Prunus virginiana*
Cinquefoil	*Potentilla spp.*
Clover	*Trifolium spp.*
Columbia needlegrass	*Stipa columbiana*
Cottonwood	*Populus trichocarpa*
Cowparsnip	*Heracleum lanatum*
Dalmatian toadflax	*Linaria dalmatica*
Dandelion	*Taraxacum officinale*
Deathcamas	*Zygadenus venenosus*
Deervetch	*Lotus spp.*
Dock	*Rumex spp.*
Dogbane	*Apocynum androsaemifolium*
Douglas-fir	*Pseudotsuga menziesia*
Elderberry	*Sambucus spp.*
Elk sedge	*Carex geyeri*
Englemann spruce	*Picea englemanni*
Fleabane	*Erigeron spp.*
Geranium	*Geranium spp.*
Goatweed (St. Johnswort)	*Hypericum perforatum*
Grand fir	*Abies grandis*
Groundsel	*Senecio spp.*
Hawthorn	*Crataegus spp.*
Huckleberry	*Vaccinium spp.*
Idaho fescue	*Festuca idahoensis*
Iris	*Iris spp.*
Kentucky bluegrass	*Poa pratensis*
Larkspur	*Delphinium spp.*
Leafy spurge	*Euphorbia esula*
Lodgepole pine	*Pinus contorta*
Lupine	*Lupinus spp.*
Maple	*Acer circinatum*
Medusahead rye	*Elymus caput-medusae*
Mint	*Mentha spp.*
Mockorange	*Philadelphus spp.*
Monkeyflower	*Mimulus spp.*
Mountain bromegrass	*Bromus marginatus*
Mustard	*Brassica spp.*
Nettle	*Urtica spp.*
Ninebark	*Physocarpus spp.*
Oceanspray	*Holodiscus discolor*
Pachistima	*Pachistima myrsinites*
Phlox	*Phlox spp.*
Pinegrass	*Calmagrostis rubescens*
Plantain	*Plantago spp.*
Poisonous waterhemlock	*Cicuta douglasi*
Ponderosa pine	*Pinus ponderosa*
Prairie junegrass	*Koeleria cristata*
Pussytoes	*Antennaria spp.*
Quackgrass	*Agropyron repens*
Rabbitbrush	*Chrysothamnus spp.*
Red-osier dogwood	*Cornus stolonifera*
Redstem ceanothus	*Ceanothus sanguineus*
Redtop	*Agrostis alba*
Reed canarygrass	*Phalaris arundinacea*
Rose	*Rosa spp.*
Rush	*Juncus spp.*
Saltgrass	*Distichlis stricta*
Sandberg bluegrass	*Poa secunda*
Scab sage	*Artemisia rigida*
Sedge	*Carex spp.*
Serviceberry	*Amelanchier spp.*
Slender wheatgrass	*Agropyron trachycaulum*
Snowberry	*Symphoricarpos albus*
Snowbrush	*Ceanothus velutinus*
Spirea	*spiraea spp.*
Strawberry	*Fragaria spp.*
Stonecrop	*Sedum spp.*
Subalpine fir	*Abies Lasiocarpa*
Sweet-anise	*Osmorhiza occidentalis*
Tarweed	*Madia spp.*
Thimbleberry	*Rubus parviflorus*
Timothy	*Phleum pratense*
Tufted hairgrass	*Deschampsia caespitosa*
Twinberry	*Linnaea borealis*
Western helmock	*Tsuga heterophylla*
Western larch	*Larix occidentalis*
Western redcedar	*Thuja plicata*
Western white pine	*Pinus monticola*
Willow	*Salix spp.*
Wild onion	*Allium spp.*
Yarrow	*Achillea millefolium*

ALKALI SITE

This range site consists of one level, somewhat poorly drained soil of the Emdent series, which occurs as depressions in the channeled scablands in the southwestern corner of the county. Salts have accumulated in this soil in amounts that are toxic to some plants. The annual precipitation is 15 to 18 inches. Plant growth is affected by somewhat poor drainage, by salts, and by a seasonally high water table. The high water table retards the growth of plants but extends the period of growth into summer and the early part of fall. Conditions for plant growth are optimum between May 15 and September 1.

About 75 percent of the potential vegetation consists of basin wildrye and saltgrass; 20 percent of alkali bluegrass, alkali cordgrass, quackgrass, sedge, and rush; and 5 percent of such common forbs as plantain, yarrow, dandelion, and cinquefoil.

Basin wildrye and alkali bluegrass decrease if the range is overgrazed, while saltgrass, which provides less forage, increases. The total annual yield is about 4,000 pounds per acre when the range is in excellent condition.

BOTTOMLAND SITE

This range site consists of soils of the Caldwell, Latah, and Mondovi series, which occur mostly along the smaller streams in the county and in drained depressions in the channeled scablands. This site is subject to flooding during spring runoff, and the soils are saturated for short

periods in spring. The annual precipitation ranges from 15 to 23 inches. Generally the supply of soil moisture is favorable for plant growth in spring and early in summer but is not sufficient to extend the period of growth beyond July 30.

About 60 percent of the potential vegetation on this site consists of basin wildrye; 20 percent of Kentucky bluegrass, quackgrass, and small amounts of slender wheatgrass, timothy, and sedge; 10 percent of forbs, such as clover, cinquefoil, lupine, dock, iris, and blue camas; and 5 percent of shrubs, such as rose, currant, snowberry, elderberry, hawthorn, chokecherry, willow, and alder. Poisonous waterhemlock grows in some places along streambanks.

Basin wildrye decreases if the range is overgrazed, and Kentucky bluegrass, quackgrass, and shrubs, which provide less forage, increase. The total annual yield ranges from 10,000 to 5,000 pounds per acre when the range is in excellent condition.

WET MEADOW SITE

This range site consists of soils of the Bridgeson, Cocolalla, Konner, Peone, Semiahmoo, and Wethey series, which occur throughout the county as small to rather large wet meadows around lakes and along streams and as nonsaline depressions in the channeled scablands. Drainage is poor or very poor. Ponding is common in the spring, and the soils may remain saturated 8 months of the year. Rapid plant growth begins after the ponded water drains off and continues until frost in the fall.

About 70 percent of the potential vegetation consists of tufted hairgrass and canarygrass; 20 percent of sedge, redtop, and rush; 5 to 10 percent of common forbs, such as dock, nettle, cowparsnip, buttercup, sweetanise, waterhemlock, groundsel, monkeyflower, and mint; 0 to 5 percent of shrubs, such as willow, red-osier dogwood, spirea, snowberry, and rose. In many areas, the shrubs form a fringe around the meadows, along with aspen, cottonwood, birch, and alder.

Tufted hairgrass decreases rapidly when the range is overgrazed, and redtop, which provides less forage, increases along with sedges, rushes, and shrubs.

The total annual yield ranges from 6,000 to 3,000 pounds per acre when the range is in excellent condition. Plant growth is most rapid and the amount of forage available is greatest in years when precipitation is less than normal and the water table, consequently, is lower.

SHALLOW SITE

This range site consists of soils of the Bong, Cheney, Garrison, Palouse, Phoebe, and Uhlig series, which occur as small to extensive areas in the southwestern and central parts of the county. The average annual precipitation ranges from 15 to 25 inches, and about 80 percent of it occurs in the period of October through June. Summers are hot and dry, but occasional summer showers aid plant growth in most years. Fall rains usually come early enough to produce some green forage. Conditions for plant growth are optimum between May 1 and July 1.

About 70 percent of the potential vegetation on this site consists of bluebunch wheatgrass and Idaho fescue; 10 percent of Sandberg bluegrass, bottlebrush squirreltail, prairie junegrass, and Columbia needlegrass; 10 percent of common forbs, such as arrowleaf balsamroot, biscuitroot, lupine, geranium, groundsel, cinquefoil, buckwheat, and astragalus; 10 percent of shrubs, such as snowberry, rose, serviceberry, spirea, chokecherry, and mockorange. A few scattered ponderosa pines may be present.

Overgrazing causes bluebunch wheatgrass and Idaho fescue to decrease. At first these are replaced mostly by Sandberg bluegrass and Columbia needlegrass, by balsamroot and other perennial forbs, and by rabbithbrush. If overgrazing continues, the site is invaded by weedy plants, mainly cheatgrass, mustard, and other annual plants. Also, medusahead rye, leafy spurge, dalmatian toadflax, goatweed, and other noxious weeds can become established.

The total annual yield ranges from 1,600 to 900 pounds per acre when the range is in excellent condition.

All the soils of this site, except those with many surface stones, can be tilled and drill seeded to perennial forage plants.

LOAMY SITE

This range site consists of level to steep soils of the Athena, Lance, Bong, Garrison, Glenrose, Phoebe, Reardan, Schumacher, and Uhlig series. These soils occur on outwash terraces in the Spokane Valley, on a large part of the silty uplands, and on the sparsely wooded uplands and scattered buttes south and southwest of Spokane. The annual precipitation ranges from 15 to 25 inches, and about 85 percent of it occurs between October 1 and June 15. Although summers are hot and dry, a few summer storms normally provide enough moisture to aid plant growth. Also, there is usually enough moisture in fall to produce some green forage. Conditions for plant growth are optimum between May 1 and July 15. A large part of this site is used for crops and for hay and pasture.

About 70 percent of the potential vegetation consists of bluebunch wheatgrass and Idaho fescue; 15 percent of Sandberg bluegrass, Kentucky bluegrass, bottlebrush squirreltail, and prairie junegrass; 12 percent of common forbs, such as biscuitroot, lupine, balsamroot, geranium, astragalus, cinquefoil, groundsel, larkspur, and phlox; and 3 percent of shrubs, such as snowberry, rose, chokecherry, serviceberry, and mockorange. In places there are a few ponderosa pines.

Bluebunch wheatgrass and Idaho fescue decrease if the range is overgrazed, while Sandberg bluegrass and perennial forbs such as lupine, balsamroot and cinquefoil increase at first. Then, if overgrazing continues, cheatgrass, mustard, tarweed, and bullthistle invade the site. Goatweed, dalmatian toadflax, leafy spurge, medusahead rye, and other noxious weeds easily become established if the range is abused.

The total annual yield varies between 2,400 and 1,500 pounds per acre when the range is in excellent condition.

All of the soils in this site are suitable for seedbed preparation and for drill seeding to perennial forage plants.

NORTH EXPOSURE SITE

This range site consists of steep and very steep soils of the Athena, Glenrose, Palouse, and Schumacher series. These soils occupy the northern exposures of glasslands and sparsely wooded uplands and buttes, mostly south and west of Spokane. The annual precipitation ranges from 16 to 23 inches, and about 75 percent of it occurs between October 1 and June 15. Although the summers are hot and dry, temperature and evaporation are more favorable to plant growth than on adjacent sites. There is usually enough moisture early in fall to produce some regrowth of

bunchgrass. Optimum conditions for bunchgrass occur between May 1 and August 1.

About 70 percent of the potential vegetation consists of Idaho fescue; 10 percent of bluebunch wheatgrass, bluegrass, prairie junegrass, and mountain bromegrass; 10 percent of such forbs as arrowleaf balsamroot, biscuitroot, lupine, geranium, groundsel, cinquefoil, larkspur, and alumroot; and 10 percent of such shrubs as snowberry, rose, serviceberry, spirea, chokecherry, and mockorange. Scattered trees or sparse stands of ponderosa pine and Douglas-fir are also present.

If this site is overgrazed, Idaho fescue and bluebunch wheatgrass decrease while bluegrass and perennial forbs and shrubs increase. If overgrazing continues, cheatgrass and other undesirable weeds grow more abundantly; then goatweed, medusahead rye, leafy spurge, and other noxious weeds become established.

All of the soils except the very rocky parts of Palouse silt loam and the soils that have slopes of more than 45 percent are suitable for seedbed preparation and for drill seeding to perennial forage plants for range or pasture.

The total yield varies from 2,600 to 2,000 pounds per acre when the range is in excellent condition.

Woodland [3]

Forty percent of Spokane County is woodland (*11*).[4] Eighty-three percent of the woodland is privately owned, and the rest is publicly owned—10 percent by the State, 3 percent by the county, and 4 percent by the Federal government.

The county has one large sawmill, a number of small mills, and a pulp and paper mill. Some logs are shipped to larger sawmills outside the county. Pulpwood and chips are shipped a considerable distance to mills outside the county and outside the State.

Intensive woodland management has not been practiced for very long in this county, but management is improving as a result of conservation programs, an expanding market, and educational work by public and private foresters. In Mount Spokane and Riverside State Parks and on several military reservations, no cutting of timber is permitted. The U.S. Fish and Wildlife Service is practicing intensive management of its large woodland holding in the Turnbull National Wildlife Refuge in the southwestern part of the county. Most of the rest of the forested land has been logged one or more times.

Woodland protection

The woodland in the county is protected by the State Department of Natural Resources or by local fire districts. The large population and expanding industrial facilities of the city of Spokane make accidental fires a constant threat, especially during hot, dry summers.

The soils of the county do not appear to have a marked effect on the incidence of disease or insect infestation. Dwarf mistletoe (*Arceuthobium spp.*) and blister rust (*Cronartium ribicola*) are the principal diseases of trees in the woodland. Dwarf mistletoe seriously affects the growth of ponderosa pine, lodgepole pine, Douglas-fir, and larch. No means of combating it has been found. Blister rust affects white pine.

The Oregon pine engraver beetle (*Ips Oregoni*) does considerable damage to young pine stands, but a knowledge of the beetle's breeding and feeding habits is helping to reduce the damage.

Many kinds of rust, needle scale, bark insects, and foliage moths are endemic to the area. The damage they do varies according to the climate.

Forested soils of the county

The forested soils in Spokane County range from shallow to deep and from gravelly and sandy to medium textured. Because of differences among the soils, as well as differences in climate and geology, the forests vary in composition and productivity from sparse stands of pine in the tree-grass transition zone to dense stands of mixed conifers on upland terraces and mountains.

In the southwestern corner of the county, the elevation is 1,700 feet, and the annual precipitation amounts to about 15 inches. Many soils in this area support pure stands of ponderosa pine. Past geological action formed these soils into biscuits, channeled scablands, and outwash plains. The timber sites range from poor on the shallow scablands to fair or good on some of the deeper soils around potholes.

As the elevation increases to the north and east, deep sands and sandy loam terraces and benches are common along the Spokane and Little Spokane Rivers. These soils support low-producing stands of ponderosa pine.

Extending northward and eastward from these benches are soils that range from the gravelly, droughty Springdale soils, which support poor stands of ponderosa pine, to deep, medium-textured soils, which support excellent stands of western white pine, Douglas-fir, and larch. Between these extremes are many soils derived from glacial sediments and stream deposits. They support a mixture of ponderosa pine, Douglas-fir, larch, and lodgepole pine. This area receives from 18 to 22 inches of precipitation annually. Many of the soils have a high water-supplying capacity and can provide moisture during the droughty summer months. These soils are commonly in the middle site-class range. The productivity of the site is affected by the variations in soil depth, the restrictive layers, and the texture. In many of these soils, clay bands in the subsoil increase the water-supplying capacity, thereby increasing the productivity of the site.

Much of the woodland in the southwestern part of the county is well suited to grazing. Bunchgrass is the principal forage plant when the range is in good condition. Because of the coarse and medium texture of the soils, compaction is not a serious problem if the range is properly managed. Most of the woodland areas in the county are grazed to a limited extent. The amount of usable forage varies with the age and density of the woodland and past cutting practices.

Woodland suitability groupings

To aid those who manage woodland, the soils in Spokane County that are used principally as woodland have been grouped according to their suitability for trees. These groups are described in the following pages. The factors that were used as a basis for the grouping are defined as follows:

[3] This section was prepared by R. J. OLSON, woodland conservationist, Soil Conservation Service.

[4] Italic numbers in parentheses refer to Literature Cited, p. 142.

Potential soil productivity is the estimated yield of each forest type or single species that a given soil can produce under a specified level of management. *Site index* is the most common measurement of potential soil productivity. Site index is the average height attained by the dominant and codominant trees at 50, 80, or 100 years of age, depending on the species. Site indexes can be grouped into five or seven classes, depending on the species of trees. Class I is high or excellent; classes VI and VII are poor.

The yield estimates, site index ratings, and site classes for ponderosa pine in this report are based on data in USDA Technical Bulletin 630 (*6*); those for lodgepole pine are based on data compiled by the British Columbia Forest Service; and those for mixed conifers, which are in the western white pine forest type, are based on USDA Technical Bulletin 323 (*3*). Because adequate yield tables have not been developed for inland Douglas-fir and larch, the data for ponderosa pine were used and correlated with existing data on Douglas-fir and larch. The yields of ponderosa pine, lodgepole pine, and mixed conifers are given in tables 3, 4, and 5.

Erosion hazard is the risk of erosion in undisturbed areas as well as in areas that are disturbed by skidding, road building, or other logging operations. The rating of the hazard ranges from slight to severe.

Equipment limitation depends on slope, rock outcrops, soil stability, the condition of the soil when frozen or wet, and on other features that affect the use of equipment. The limitation is *slight* if the soils are sandy, well drained, and level; little or no road construction is required; and operations are not generally hampered by heavy snows, wet weather, or other factors. The limitation is *moderate* if the soils are rolling to steep; logging is slowed down or stopped in winter and early in spring because the soils are wet and slippery. The limitation is *severe* if the soils are steep or rock outcrops are common.

Plant competition refers to the tendency of a site to "brush up" with understory vegetation. Competition is *slight* if understory vegetation is slow to occupy the site and trees establish themselves readily if there are adequate sources of seed. Competition is *moderate* if brush and grass dominate the site for a time but trees generally establish themselves naturally. Planting may be desirable to hasten the establishment of a stand. Competition is *severe* if brush and grass tend to crowd out tree seedlings. Seed and weather conditions must be ideal for trees to establish themselves. Planting may be necessary to obtain adequate stocking.

Restocking potential refers to the effect of the soil on the survival of seedlings, whether they occur naturally in the stand or are planted. Surface temperature, soil texture, and water-supplying capacity are the major factors that affect survival. The restocking potential is *good* if some loss occurs as a result of summer drought, but the survival rate generally is high. The potential is *fair* if summer drought and high surface-soil temperature affect reproduction, but in most years the survival rate is adequate. The potential is *poor* if the soils are so droughty or shallow or the surface temperature is so high that trees cannot regenerate naturally and the survival rate is low, even though seedlings are set out when planting conditions are most favorable.

Grazing value is an indication of the amount of forage and browse that the understory can provide. The amount depends on the natural openings in the stands, the soil type, the productivity of the soil, and the kind of understory plants that grow on the site.

Forest types are those that have been described in "Forest Cover Types of North America" (*9*).

The *potential understory vegetation* is determined by measuring the weight of the annual growth of the understory plants. The common and scientific names of the principal trees and understory plants are listed in the range section of this report.

TABLE 3.—*Yields from unmanaged, fully stocked stands of ponderosa pine*

[Board feet per acre, according to Scribner rule, of trees 11.6 inches in diameter and larger. Blank spaces indicate no significant volume is produced]

Age	Site Index [1]						
	50	60	70	80	90	100	110
Years	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
20							100
30					200	1,000	2,500
40			100	600	1,900	4,300	7,500
50		100	700	2,300	5,000	9,200	14,000
60		600	2,200	5,100	9,100	14,800	21,000
70	300	1,800	4,300	8,500	13,800	20,500	27,800
80	900	3,500	7,000	12,200	18,500	26,000	34,200
90	2,000	5,500	10,000	16,000	23,000	31,200	40,200
100	3,400	7,800	13,100	19,700	27,200	36,100	45,800
110	5,000	10,200	16,200	23,100	31,100	40,600	50,800
120	7,000	12,500	19,000	26,200	34,700	44,600	55,400
130	8,900	14,700	21,500	29,000	38,000	48,300	59,600
140	10,700	16,700	23,700	31,500	40,900	51,700	63,400
150	12,400	18,500	25,700	33,800	43,600	54,800	66,900

[1] The site index range within each site class is as follows: class I—113 plus; class II—99 to 112; class III—85 to 98; class IV—71 to 84; class V—57 to 70; class VI—43 to 56; class VII—42 or less.

TABLE 4.—*Yields from unmanaged, fully stocked stands of lodgepole pine*

[Cubic feet per acre from trees 6 inches or more in diameter and up to 3 inches in diameter at top. Multiply number of cubic feet by 6 to convert to approximate number of board feet; divide number of cubic feet by 90 to convert to approximate number of cords. Blank spaces indicate no significant volume is produced]

Age	Site index [1]					
	40	50	60	70	80	90
Years	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
20	-------	-------	-------	-------	-------	-------
30	-------	-------	-------	148	425	700
40	76	200	410	945	1, 560	2, 080
50	400	630	1, 150	2, 050	2, 830	3, 570
60	835	1, 220	2, 000	3, 150	4, 200	4, 860
70	1, 250	1, 790	2, 700	4, 220	5, 300	5, 860
80	1, 710	2, 350	3, 400	5, 200	6, 200	6, 800
90	2, 100	2, 840	4, 060	5, 920	6, 920	7, 580
100	2, 400	3, 230	4, 600	6, 520	7, 550	8, 150
110	2, 700	3, 600	5, 130	7, 000	8, 060	8, 680
120	2, 900	3, 850	5, 600	7, 400	8, 450	9, 100
130	3, 120	4, 120	5, 900	7, 650	8, 750	9, 500
140	3, 320	4, 250	5, 910	7, 850	9, 000	9, 650
150	3, 440	4, 350	6, 070	8, 030	9, 100	9, 800

[1] Site index range within each site class is as follows: class I—86 plus; class II 76 to 85; class III—66 to 75; class IV—56 to 65; class V—46 to 55; class VI—45 or less.

TABLE 5.—*Yields from unmanaged, second-growth stands of mixed conifers in the western white pine forest type*

[Board feet per acre, according to Scribner rule, of trees 12.6 inches in diameter and larger; blank spaces indicate no significant volume is produced]

Age	Site index [1]					
	40	50	60	70	80	90
Years	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
40	-------	-------	-------	-------	400	1, 400
50	-------	-------	50	800	3, 300	7, 000
60	-------	50	700	3, 700	10, 300	17, 800
70	100	600	2, 800	9, 700	21, 200	34, 000
80	500	2, 300	6, 500	17, 900	34, 600	50, 500
90	1, 600	4, 800	12, 100	28, 700	50, 300	65, 500
100	3, 300	8, 300	19, 200	40, 300	63, 200	79, 100
110	5, 400	12, 400	26, 100	50, 800	73, 400	88, 600
120	7, 600	16, 000	32, 200	59, 000	81, 000	96, 000
130	9, 500	18, 800	37, 000	65, 200	87, 000	(2)
140	10, 900	21, 000	41, 000	70, 500	91, 600	(2)
150	11, 700	22, 700	43, 800	74, 400	94, 800	(2)

[1] Site index range within each site class is as follows: class I—66 plus; class II—56 to 65; class III—46 to 55; class IV—36 to 45; class V—less than 35.

[2] No data.

WOODLAND GROUP 1

This group consists of level to very steep soils of the Vassar series. These soils are on mountainous uplands at elevations above 3,000 feet near Mount Spokane and Mica Peak. They are deep or very deep, medium textured, and moderately permeable. The annual precipitation, mostly snow, ranges from 30 to 45 inches. The fertility is medium.

The common forest types on these soils are western white pine, grand fir—larch—Douglas-fir, and, at the highest elevations, Engelmann spruce—subalpine fir. These types include western hemlock, western redcedar, and lodgepole pine. The soils of this site have a rating of class I for Douglas-fir and larch and class III for western white pine and lodgepole pine. Logging practices, fires, and stages in succession toward the climax vegetation have a marked effect on the composition of the stands.

The hazard of erosion is slight in undisturbed areas but is moderate to severe in areas that have been burned or logged. Shrubs, trees, and grass, however, quickly cover exposed soil.

Steep slopes, heavy winter snows, and, in some places, rock outcrops are moderate to severe limitations on the use of equipment.

The restocking potential is good. Plant competition is moderate and generally does not limit the regeneration of stands. If brush does become established, regeneration is retarded and conditions are favorable for species that can grow in the shade of the undergrowth. Regeneration after logging depends on the size of the opening in the canopy, the availability of seed, and the direction of the slope. Hemlock, cedar, and grand fir generally come in as understory or in small openings. White pine comes into larger areas that are partly protected. Western larch and lodgepole pine grow in solid stands in many large clearings or burns.

The grazing value of the understory is very low. Logging operations and fires sometimes open the stands and make limited forage and browse available, but as soon as the trees form a canopy, the grazing value of the understory declines. The principal understory plants are pinegrass, elk sedge, thimbleberry, huckleberry, ninebark, and oceanspray. Beargrass is a part of the understory at the higher elevations, and rose and snowberry at the lower elevations.

These soils are important in the watersheds because they receive heavy snows and have a high water-holding capacity. They support a variety of vegetation and thus provide excellent habitats for many kinds of wildlife. The dense stands of timber, the ample supply of clear water, and the cool climate make them desirable for many recreational purposes.

WOODLAND GROUP 2

This group consists of level to very steep soils of the Moscow series. These soils are on mountainous uplands at elevations above 2,800 feet in the areas of Mount Spokane and Mica Peak. They are moderately deep or deep, medium textured, well drained, and moderately permeable. The annual precipitation, mostly snow, ranges from 20 to 27 inches. The fertility is low, and the water-supplying capacity is moderate.

Grand fir—larch—Douglas-fir is the common forest type on these soils, but the stands are mixed and include cedar, western white pine, hemlock, and ponderosa pine. Hemlock is common on the north-facing slopes where moisture is ample, and ponderosa pine comes into the stand on the drier, more exposed sites. The site rating is class II for ponderosa pine, Douglas-fir, larch, lodgepole pine, and western white pine.

The hazard of erosion is slight in undisturbed areas but is moderate to severe in logged or burned areas. Erosion

can be controlled by laying out roads carefully, using water bars or barriers, and keeping roads and skid trails to a minimum grade.

Equipment limitations are moderate to severe, depending on the season and the steepness of slope. These soils are not excessively slippery when wet.

The restocking potential is good. Plant competition is severe in exposed areas, and regeneration is limited. Where brush is not a limiting factor or where planting stock is used, stands can be restocked without difficulty.

The grazing value of the understory is very low. The forage is mostly browse, and the amount depends on the size of the openings in the canopy. Pachistima, ninebark, huckleberry, and pinegrass are the principal understory plants. Redstem ceanothus and elk sedge occur at the lower elevations. Maple, snowberry, and alder also grow in the understory.

WOODLAND GROUP 3

This group consists of very deep or deep, level to very steep soils of the Cedonia, Clayton, Green Bluff, Lakesol, and Laketon series. These soils are on terraces and plateaus at elevations of 1,800 to 2,500 feet near Deer Park and Green Bluff. They are medium textured or moderately coarse textured and moderately well drained or well drained. They receive from 19 to 24 inches of precipitation a year. The water-supplying capacity is high.

These soils support a mixed forest of the ponderosa pine—larch—Douglas-fir type, as well as many dense stands of lodgepole pine. The site rating is class II for ponderosa pine, Douglas-fir, larch, and lodgepole pine. White pine and grand fir grow on the Laketon soils, which are moderately well drained.

The hazard of erosion is slight to severe. It is moderate to severe on the steeper slopes that are logged, burned, or cleared, but trees and understory plants quickly cover exposed soil. The equipment limitations are slight.

Plant competition is slight. Although understory plants quickly occupy exposed sites, the restocking potential is good, and natural regeneration generally keeps the stands dense and uniform. Planting should be successful on these soils, also.

The naturally dense stands limit the growth of forage. The grazing value is generally low or very low but may be moderate on some areas of the Lakesol soils. The principal understory plants are pachistima, twinberry, spirea, snowberry, elk sedge, pinegrass, bearberry, and huckleberry.

WOODLAND GROUP 4

This group is made up of level to very steep soils of the Bernhill series. These soils are at elevations of 2,300 to 4,000 feet on the glaciated upland in the central part of the county and on buttes near Fairfield and Latah. They are well drained, medium textured, and moderately deep to very deep. They receive about 21 inches of precipitation annually. The water-supplying capacity is moderate to high. The fertility is medium.

These soils support a forest of the ponderosa pine—larch—Douglas-fir type. The site rating is class III for ponderosa pine, Douglas-fir, and larch and class IV for lodgepole pine. Douglas-fir is the most common species; ponderosa pine grows on the more exposed, droughty sites; and lodgepole pine or larch may come into the stand where moisture conditions or past cutting practices have made conditions favorable.

The erosion hazard is moderate to severe. Logging roads should have minimum grades and should be protected by water bars and other erosion control devices.

Equipment limitations are moderate. These soils hold snow until late in spring, and they are slippery when wet or frozen. The steeper slopes also restrict the use of equipment.

The restocking potential is good because the soils are shaded, and moisture conditions are favorable for plantings. Plant competition is severe and may retard the regeneration of a stand or the establishment of planted stock.

The grazing value of the understory is very low because of the dense stands of trees and the heavy brush. The principal understory plants are ninebark, snowberry, redstem ceanothus, elk sedge, and pinegrass.

WOODLAND GROUP 5

This group consists of level to steep soils of the Dearyton, Freeman, and Larkin series. These soils are at elevations of 2,400 to 3,000 feet on upland plateaus and foot slopes in the central part of the county. They are deep or very deep, are well drained or moderately well drained, and have a slowly permeable claypan. They receive from 20 to 23 inches of precipitation annually, and their water-supplying capacity is moderate or moderately high. The fertility is medium.

These soils originally supported mixed stands of ponderosa pine and Douglas-fir, but nearly all of the acreage of Freeman soils has been cultivated and much of the acreage of Dearyton and Larkin soils. The common forest cover now is ponderosa pine; some Douglas-firs and grand firs grow in shaded or protected areas. The site rating is class III.

The hazard of erosion is slight under forest cover, but severe in logged, burned, or cleared areas, even on gentle slopes.

During wet weather these soils are saturated above the slowly permeable claypan, and the use of equipment is moderately limited. Because the claypan restricts the growth of roots, windthrow may occur along the edges of large openings.

The restocking potential is good. Plant competition is moderate, but stands usually regenerate by natural seeding, even though undergrowth quickly covers exposed soil.

The grazing value of the forage is generally low, but it varies with the topography, the canopy density, and the condition of the understory. The principal understory plants are bluebunch wheatgrass, Idaho fescue, sedge, pinegrass, serviceberry, rose, and snowberry.

WOODLAND GROUP 6

This group is made up of level to very steep, shallow and moderately deep soils of the Moscow and Spokane series. These soils are on mountainous uplands and foot slopes at elevations ranging from 2,000 to 5,000 feet in the areas of Mount Spokane and Mica Peak. They are medium textured, well drained, and moderately permeable. They receive from 22 to 27 inches of precipitation annually. Their water-supplying capacity is low to moderate, and their fertility is low to medium.

Douglas-fir and ponderosa pine are the forest types on these soils, and the site rating is class III. Larch and

grand fir are adapted to draws and wet areas. The hazard of erosion is slight under forest cover. It is moderate or severe in cultivated, logged, or burned areas, depending on steepness of slope.

Equipment limitations are moderate or severe, depending mainly on the steepness of slope.

The restocking potential is only fair. The survival rate of stock planted on the drier slopes may be low because of the high temperature of the surface soil. Plant competition is moderate, and the competition for moisture limits regeneration of stands on the drier slopes. Windthrow occurs on the shallow soils but is not common.

About 70 percent of the potential understory consists of bluebunch wheatgrass and Idaho fescue; 5 percent of prairie junegrass, threadleaf sedge, elk sedge, pinegrass, and Sandberg bluegrass; 15 percent of common forbs—lupine, buckwheat, balsamroot, geranium, cinquefoil, blue-eyed-grass, astragalus, and biscuitroot; and 10 percent of shrubs and trees—spiera, snowberry, rose, serviceberry, ponderosa pine, and some Douglas-fir.

As a result of overgrazing, Idaho fescue and bluebunch wheatgrass decrease, while Sandberg bluegrass and Columbia needlegrass increase, along with balsamroot, lupine, and other less palatable plants. Cheatgrass, dalmatian toadflax, medusahead rye, and goatweed invade if overgrazing continues.

If the understory has not been overgrazed, and is in excellent condition, the total annual yields are as follows:

Class of canopy	*Pounds per acre*
Open (0 to 10 percent shade)	900 to 700
Sparse (10 to 40 percent shade)	700 to 450
Medium (40 to 70 percent shade)	450 to 100
Dense (70 to 100 percent shade)	100 to 0

WOODLAND GROUP 7

This group consists of level to very steep, moderately shallow and moderately deep soils of the Spokane and Tekoa series. These soils are on mountains and foot slopes at elevations ranging from 2,000 to 4,000 feet. They are medium textured, well drained, and moderately permeable, and most of them are gravelly or stony. The annual precipitation ranges from 18 to 24 inches. The water-supplying capacity and the fertility are low.

Ponderosa pines and scattered Douglas-firs grow on these soils. Ponderosa pine is the common forest type, and the site rating is class IV or V, depending on soil depth and exposure. Timber stands tend to be open and scattered on south-facing slopes, but the deeper pockets of soil and some of the north-facing slopes support dense stands of pine and fir.

The hazard of erosion is slight under forest cover but is moderate to severe in cultivated, logged, or burned areas. In these areas the hazard is moderate on slopes of up to 30 percent and severe on steeper slopes. Equipment limitations are moderate on the steep slopes.

The restocking potential is fair to poor. High temperature at the surface of the soil may severely reduce the rate of survival of planted stock. Plant competition is moderate, and the competition for moisture limits the regeneration of stands on the dryer slopes. Some windthrow occurs on the shallower soils, but windthrow is not a serious problem.

On south-facing slopes, 70 percent of the potential understory consists of bluebunch wheatgrass and Idaho fescue; 5 percent of prairie junegrass, threadleaf sedge, elk sedge, pinegrass, and Sandberg bluegrass; 15 percent of common forbs—lupine, buckwheat, balsamroot, geranium, cinquefoil, blue-eyed-grass, astragalus, and biscuitroot; and 10 percent of shrubs and trees—spirea, snowberry, rose, serviceberry, ponderosa pine, and Douglas-fir.

Overgrazing results in a decrease in Idaho fescue and bluebunch wheatgrass and an increase in Sandberg bluegrass, Columbia needlegrass, balsamroot, lupine, and other less palatable plants. Cheatgrass, dalmatian toadflax, medusahead rye, goatweed, and annual weeds invade if overgrazing continues.

If the understory has not been overgrazed and is in excellent condition, the total annual yields are as follows:

Class of canopy	*Pounds per acre*
Open (0 to 10 percent shade)	900 to 700
Sparse (10 to 40 percent shade)	700 to 450
Medium (40 to 70 percent shade)	450 to 100
Dense (70 to 100 percent shade)	100 to 0

WOODLAND GROUP 8

This group is made up of level to steep, shallow to deep soils of the Bernhill, Dragoon, and Speigle series. These soils occur on colluvial slopes, hilly uplands, and glaciated mountain foot slopes at elevations of 1,900 to 3,000 feet. They are medium textured, moderately permeable, and well drained. Some of these soils are stony or gravelly. The annual precipitation ranges from 16 to 21 inches. The water-supplying capacity is moderate, and the fertility is low.

Douglas-fir and ponderosa pine are the forest species on these soils, and the rating is class IV. As most areas of these soils are on north-facing slopes, dense stands of Douglas-fir and some ponderosa pine are common. Generally the Dragoon soils are forested only on north-facing slopes.

The hazard of erosion is slight under forest cover but is moderate to severe in areas that have been cultivated, logged, or burned. In these areas the hazard is moderate on slopes of up to 30 percent and severe on steeper slopes.

Steep slopes, stones, and shallowness moderately limit the use of equipment. Slipperiness when the soils are wet is also a limitation in some areas.

The restocking potential is only fair. The rate of survival of planted stock may be good on north-facing slopes but poor on the shallow soils and on the exposed slopes. Plant competition is moderate after logging, but stands usually regenerate over a period of time.

The grazing value of the understory is generally very low. The amount of forage on the north-facing slopes is limited by the dense stands of trees and brush.

WOODLAND GROUP 9

Only one soil is in this group. It is a very deep, somewhat excessively drained sandy soil of the Hagen series. This soil is in level to dunelike areas north of Spokane at elevations ranging from 1,900 to 2,100 feet. It receives about 22 inches of precipitation annually. The water-supplying capacity is moderate, and the fertility is low.

This soil supports a forest of ponderosa pine, which occurs as pure stands on the dunes and in combination with lodgepole pine on the more nearly level or more moist sites. The site rating normally is class II for ponderosa pine and lodgepole pine, but the rating for ponderosa pine may be only class IV on droughty sites.

The hazard of water erosion is slight, but the hazard of wind erosion is severe. Loose sand when the soil is dry slightly limits the use of equipment. The restocking potential is fair. Plant competition is slight, and regeneration after logging is generally adequate. High temperature at the surface of the soil may cause loss of seedlings.

Pinegrass, snowbrush, and bearberry (kinnikinnick) are the principal understory plants. The grazing value is very low.

WOODLAND GROUP 10

This group consists of medium-textured, moderately well drained, permeable soils of the Hardesty series. These soils are level to gently sloping. They occur in slight depressions at the toe of terrace breaks or rock ledges. They are at elevations ranging from 1,800 to 2,500 feet and receive 18 to 25 inches of precipitation annually. The water-supplying capacity is moderate to high, and the fertility is low.

These soils are well suited to ponderosa pine. The site rating is class II. Ponderosa pine is the common forest type. Douglas-fir, lodgepole pine, and aspen also occur in some stands, depending on past management and location.

The erosion hazard and equipment limitations are slight. Most of the planted stock should survive, for the restocking potential is good. Plant competition is slight. Although brush and grass quickly invade openings, regeneration is adequate.

Snowberry, rose, and pinegrass are the principal understory plants. Because the timber stands are dense, the grazing value is low.

WOODLAND GROUP 11

This group consists of well-drained and somewhat excessively drained soils of the Bonner and Hagen series. These soils occur on level to strongly sloping terraces north of Spokane. They are at elevations ranging from 1,900 to 2,400 feet and receive from 20 to 23 inches of precipitation annually. The permeability is moderate to rapid, the water-supplying capacity is low to moderate, and the fertility is low to medium.

These soils are best suited to ponderosa pine, Douglas-fir, and lodgepole pine. Dense stands of lodgepole pine are common on the Bonner silt loam. Ponderosa pine is most common on the Hagen soil and the Bonner loam. The site rating generally is class III for ponderosa pine and Douglas-fir but may be class IV on the droughtier sites. The rating is class IV for lodgepole pine. Cutting and burning have changed the composition of the stands.

The hazard of water erosion is slight, but that of wind erosion is severe in disturbed areas of the Hagen soil. Equipment limitations are slight. The restocking potential is good to fair. Droughtiness and the high surface temperature are likely to cause loss of reproduced or planted stock. Plant competition is moderate; it seldom affects regeneration where there is an adequate source of seed.

The principal understory plants are snowbrush, pinegrass, and Oregongrape. Because the timber stands are dense, the grazing value is very low.

WOODLAND GROUP 12

This group is made up of medium-textured, well-drained, moderately permeable soils of the Eloika series. These soils occur in level to steep, undulating areas north of Deer Park. They are at elevations ranging from 2,100 to 2,400 feet and receive about 23 inches of precipitation annually. The water-supplying capacity is moderate, and the fertility is medium.

These soils are best suited to ponderosa pine, Douglas-fir, and lodgepole pine. They support dense mixed stands of Douglas-fir, larch, ponderosa pine, and lodgepole pine and have a site rating of class III. Douglas-fir is predominant on the more moist sites.

The hazard of erosion is slight to moderate. Equipment limitations are slight. The restocking potential is good. Stands regenerate rapidly, and most of the planted stock survives. Plant competition is slight.

Pinegrass, bearberry (kinnikinnick), and snowbrush are the principal understory plants. The grazing value is very low.

WOODLAND GROUP 13

This group consists of moderately deep, somewhat excessively drained, medium and moderately coarse textured soils of the Bonner series. These soils are on level to strongly sloping terraces near Deer Park. They are at elevations ranging from 2,100 to 2,400 feet and receive 20 to 23 inches of precipitation annually. The water-supplying capacity and fertility are low.

Dense, stagnating thickets of lodgepole pine and ponderosa pine are common on these soils, and the site rating is class IV. Ponderosa pine is the forest type. Some stands that have been burned or logged have failed to regenerate, and pinegrass and snowbrush are dominant in these areas.

The erosion hazard and equipment limitations are slight. The restocking potential is fair to poor. Droughtiness and high soil temperatures seriously reduce the survival of planted stock. Plant competition generally is slight, but it may prevent regeneration under severe heat and droughtiness.

The principal understory plants are snowbrush, pinegrass, junegrass, elk sedge, Oregongrape, and serviceberry. They provide forage of very low value.

WOODLAND GROUP 14

A very deep, excessively drained, coarse-textured soil of the Marble series is the only soil in this group. This level to very strongly sloping soil is in dunelike areas north of Spokane at elevations ranging from 1,700 to 2,100 feet. The annual precipitation is 18 to 20 inches. The water-supplying capacity and fertility are low.

This soil supports a forest of the pondersoa pine type. The site rating is class IV. The stands are generally open and have an understory of bunchgrass.

The hazard of water erosion is slight, but exposed soil is subject to severe wind erosion. The softness of the soil, which causes loose footing, is the major equipment limitation. The restocking potential is only fair because of droughtiness and the high surface temperature. Plant competition is slight. Competition from bunchgrass does not seriously affect the regeneration of stands.

About 70 percent of the potential understory vegetation consists of bluebunch wheatgrass and Idaho fescue; 10 percent of prairie junegrass, Sandberg bluegrass, Columbia needlegrass, and elk sedge; 15 percent of such common forbs as arrowleaf balsamroot, lupine, strawberry, yarrow, astragalus, phlox, larkspur, dogbane, pussytoes, deervetch, fleabane, deathcamas, and stonecrop; and 5 percent of such

shrubs and trees as rose, snowberry, serviceberry, snowbrush, mockorange, willow, and ponderosa pine.

Overgrazing results in a decrease in bluebunch wheatgrass and Idaho fescue and an increase in Columbia needlegrass, arrowleaf balsamroot, and snowberry. Dalmatian toadflax, goatweed, and other noxious weeds invade rapidly if overgrazing continues.

If the understory has not been overgrazed and the site is in excellent condition, the total annual yields are as follows:

Class of canopy	*Pounds per acre*
Open (0 to 10 percent shade)	700 to 500
Sparse (10 to 40 percent shade)	500 to 300
Medium (40 to 70 percent shade)	300 to 100
Dense (70 to 100 percent shade)	100 to

Drill seeding in a prepared seedbed is feasible, and so is broadcast seeding after burning, if there is enough ash to cover the seeds.

WOODLAND GROUP 15

This group is made up of somewhat excessively drained sandy and gravelly soils of the Clayton, Marble, and Springdale series. These soils are on level to strongly sloping terraces near Spokane. They are at elevations of 1,400 to 2,100 feet, and they receive from 15 to 18 inches of precipitation annually. The water-supplying capacity and fertility are low.

These soils are in areas of urban development where ample irrigation and fertilizer generally are available and trees and shrubs grow well. About 10 percent of the acreage is cultivated. Ponderosa pine is the only forest species suited to these soils, and the site rating is class V. Many of the stands are open and have an understory of bunchgrass, but dense thickets of ponderosa pine are common as a result of overgrazing, fire, or past cutting practices. These stands may stagnate for 30 years or more before individual trees express dominance.

The hazard of erosion is none to slight. Equipment limitations are slight, for these soils are fairly firm even when dry. The restocking potential is poor. Regeneration is limited mainly by droughtiness and the high surface temperature. Dwarf mistletoe is common. Plant competition is slight.

About 70 percent of the potential understory vegetation consists of bluebunch wheatgrass and Idaho fescue; 10 percent of prairie junegrass, Sandberg bluegrass, Columbia needlegrass, and elk sedge; 15 percent of such common forbs as arrowleaf balsamroot, lupine, strawberry, yarrow, astragalus, phlox, larkspur, dogbane, pussytoes, deervetch, fleabane, deathcamas, and stonecrop; and 5 percent of such shrubs and trees as rose, snowberry, serviceberry, snowbrush, mockorange, willow, and ponderosa pine.

Overgrazing causes a decrease in bluebunch wheatgrass and Idaho fescue and an increase in Columbia needlegrass, arrowleaf balsamroot, and snowberry. Dalmatian toadflax, goatweed, and other noxious weeds invade rapidly if overgrazing continues.

If the understory has not been overgrazed and is in excellent condition, the total annual yields are as follows:

Class of canopy	*Pounds per acre*
Open (0 to 10 percent shade)	700 to 500
Sparse (10 to 40 percent shade)	500 to 300
Medium (40 to 70 percent shade)	300 to 100
Dense (70 to 100 percent shade)	100 to 0

Drill seeding in a prepared seedbed is practical, and so is broadcast seeding following burning, if there is enough ash to cover the seeds.

WOODLAND GROUP 16

This group consists of medium-textured, well-drained, shallow to moderately deep soils of the Hesseltine and Dearyton series. These soils are level to steep. They occur at elevations ranging from 2,100 to 2,500 feet. Some are gravelly or stony. The annual precipitation ranges from 17 to 20 inches. The water-supplying capacity is low to moderate, and the fertility is medium.

All of these soils are suited to ponderosa pine, and it is the principal species growing on the Hesseltine soils. Douglas-fir grows in some protected areas, and aspen is common along the edge of potholes and on the toe slopes of escarpments. In general, the site rating for ponderosa pine is class V, but it ranges from class VI or VII on the stony and shallow soils to class III on the deeper phases. Narrow strips of silty clay loam along stringers and drainageways and around potholes have site ratings of class II and III.

The hazard of erosion is slight. The use of equipment is moderately limited by the stones, the high water table in depressions late in spring, shallowness, and the slippery and sticky conditions when the soils are wet.

The restocking potential is poor. The high temperature of the soil on exposed sites is the main threat to the survival of planted stock. Plant competition seldom hinders regeneration of stands. In areas that have a heavy understory of cheatgrass the fire hazard is serious.

About 70 percent of the potential understory vegetation consists of bluebunch wheatgrass and Idaho fescue; 5 percent of prairie junegrass, threadleaf sedge, elk sedge, pinegrass, and Sandberg bluegrass; 15 percent of such forbs as lupine, buckwheat, balsamroot, geranium, cinquefoil, blue-eyed-grass, astragalus, and biscuitroot; and 10 percent of such shrubs and trees as spirea, snowberry, rose, serviceberry, and ponderosa pine.

As a result of overgrazing, Idaho fescue and bluebunch wheatgrass decrease, while Sandberg bluegrass, Columbia needlegrass, balsamroot, lupine, and other less palatable plants increase. Cheatgrass, dalmatian toadflax, medusahead rye, goatweed, and annual weeds invade if overgrazing continues. Stagnated thickets of ponderosa pine occur where overgrazing, fire, or cutting practices have changed the natural plant community.

If the understory has not been overgrazed, annual yields of forage are as follows:

Class of canopy	*Pounds per acre*
Open (0 to 10 percent shade)	900 to 700
Sparse (10 to 40 percent shade)	700 to 450
Medium (40 to 70 percent shade)	450 to 100
Dense (70 to 100 percent shade)	100 to 0

WOODLAND GROUP 17

This group is made up of moderately deep to very deep, somewhat excessively drained, cobbly and gravelly sandy soils of the Marble and Springdale series. These soils occur on level to strongly sloping outwash terraces at elevations ranging from 1,300 to 2,500 feet. They receive 15 to 18 inches of precipitation annually. The water-supplying capacity and fertility are low.

Ponderosa pine is the principal species of tree, but the site rating is only class VI. Intensive woodland management is not justified.

The hazard of water erosion is slight, but wind erosion is a severe hazard on disturbed areas of the Marble soil. Equipment limitations are no more than slight.

The restocking potential is poor, mainly because of droughtiness and high soil temperature. Plant competition is slight and does not affect regeneration of stands.

About 70 percent of the potential understory vegetation consists of bluebunch wheatgrass and Idaho fescue; 10 percent of prairie junegrass, Sandberg bluegrass, Columbia needlegrass, and elk sedge; 15 percent of such forbs as arrowleaf balsamroot; lupine, strawberry, yarrow, astragalus, phlox, larkspur, dogbane, pussytoes, deervetch, fleabane, deathcamas, and stonecrop; and 5 percent of such shrubs and trees as rose, snowberry, serviceberry, snowbrush, mockorange, willow, and ponderosa pine.

Overgrazing causes a decrease in bluebunch wheatgrass and Idaho fescue and an increase in less palatable plants like Columbia needlegrass, arrowleaf balsamroot, and snowberry. Continuous overgrazing kills off the desirable forage plants and allows dalmatian toadflax, goatweed, and other noxious weeds to invade.

If the understory has not been overgrazed and the site is in excellent condition, the total annual yields are as follows:

Class of canopy	*Pounds per acre*
Open (0 to 10 percent shade)	700 to 500
Sparse (10 to 40 percent shade)	500 to 300
Medium (40 to 70 percent shade)	300 to 100
Dense (70 to 100 percent shade)	100 to 0

Drill seeding in a prepared seedbed is practical, and so is broadcast seeding after a burning, if enough ash remains to cover the seeds.

WOODLAND GROUP 18

This group is made up of imperfectly drained to moderately well drained, level to undulating soils of the Wolfeson and Narcisse series. These soils are on terraces at elevations ranging from 2,000 to 3,000 feet, and they receive 22 to 27 inches of precipitation annually. The water-supplying capacity is high. The fertility is medium or low.

Although these soils are well suited to trees, much of the acreage is used for crops and pasture. Western white pine is the common forest type. The site rating is class I for western white pine and lodgepole pine and class II for grand fir, Douglas-fir, and larch. Birch and aspen also grow on the Narcisse soils.

The hazard of erosion is slight. Wetness is a moderate equipment limitation. The restocking potential is good. Plant competition is severe on the Narcisse soil but slight on the Wolfeson soil.

The grazing value of the understory is low on the Wolfeson soil but high on the Narcisse soil. Pachistima, snowberry, rose, and pinegrass are the principal understory plants.

WOODLAND GROUP 19

A very deep, excessively drained gravelly loamy sand of the Springdale series is the only soil in this group. This soil occurs on steep to very steep terrace breaks and colluvial slopes along major drainageways at elevations ranging from 1,900 to 2,100 feet. The annual precipitation ranges from 16 to 19 inches. The water-supplying capacity and fertility are low.

Ponderosa pine is the common forest type on this soil, and the site rating is class VI. Dense stands of Douglas-fir grow on north-facing slopes, but they are of little commercial value. They are useful as permanent wildlife cover and for recreation.

The hazard of erosion is slight. Steep and unstable slopes severely limit the use of equipment. Because of droughtiness and high soil temperatures, the restocking potential is poor for planted stock and for natural regeneration.

Bluebunch wheatgrass, needlegrass, and balsamroot are the principal understory plants.

Feedlot and farmstead windbreaks

Feedlots and farmsteads in the southern and western parts of the county often need protection from strong winds. Windbreaks of trees and shrubs, well planned and maintained, will control snow drifting and erosion, provide protection for livestock and buildings, and furnish food and cover for wildlife.

A windbreak is generally composed of three or more rows—a windward row of dense, fast-growing shrubs, one or more rows of tall evergreen or deciduous trees, and a leeward row or rows of evergreens. Caragana and Russian-olive are considered the best shrubs for most of the soils in this county. Black locust and green ash are generally the preferred trees for the center rows, where height is needed. Black locust is not adapted to low areas where there is a frost hazard. Austrian pine is commonly the preferred evergreen tree for windbreaks. Scotch pine, ponderosa pine, Douglas-fir, Norway spruce, blue spruce, and Rocky Mountain juniper are all well suited. Other trees and shrubs are also suitable, but those mentioned are the most widely used.

Soils that are to be planted to windbreaks should be fall plowed and weeded before planting. Trees and shrubs that are to grow on these soils cannot compete with weeds and grass. Clean cultivation is necessary to assure good growth. Windbreaks should be protected from livestock, poultry, and fire.

Engineering Uses of Soils [5]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, underground telephone lines, building foundations, facilities for water storage, erosion control structures, drainage systems, irrigation systems, and sewage disposal systems. The properties most important to the engineer are permeability to water, shear strength, consolidation characteristics, texture, plasticity, and reaction. Depth to water table, depth to consolidated materials, and topography are also important.

The information in this report can be used to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils that will help in the planning of agricultural drainage systems, farm ponds, irrigation systems, waterways, and other structures for conservation of soil and water.
3. Make preliminary evaluations of soil conditions that will aid in selecting highway and airport locations and in planning detailed investigations of selected locations.
4. Locate probable sources of sand, gravel, rock, and other construction materials.

[5] CHRISTIAN BAFUS, Civil engineer, Soil Conservation Service, assisted in the preparation of this section of the report.

5. Correlate performance of engineering structures with soils and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that will be more useful to engineers.
8. Develop other preliminary estimates pertinent to the particular area when definite laboratory data are not available.

The engineering interpretations reported here can be useful for many purposes. It should be emphasized, however, that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or excavations deeper than the depth of the layer here reported. Even in these situations, the soil map is useful for planning more detailed field investigation and for suggesting the kinds of problems that may be expected.

Some of the terms used by soil scientists may not be familiar to engineers, and some words may have special meanings in soil science. Many of these terms are defined in the Glossary at the back of the report.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification
				USDA texture
			In.	
AaA AaC AaD AaE	Athena silt loam, 0 to 5 percent slopes. Athena silt loam, 5 to 30 percent slopes. Athena silt loam, 30 to 55 percent slopes. Athena silt loam, 55 to 70 percent slopes.	Very deep, medium-textured, well-drained soils formed from silt; occur on rolling to very steep uplands.	0 to 60	Silt loam
AlC AlD	Athena-Lance silt loams, 0 to 30 percent slopes. Athena-Lance silt loams, 30 to 55 percent slopes.	Athena part similar to Athena silt loam soils. For Lance part, see Lance soils in this table.		
BaB BaC BaD	Bernhill silt loam, 0 to 20 percent slopes. Bernhill silt loam, 20 to 30 percent slopes. Bernhill silt loam, 30 to 55 percent slopes.	Well-drained, medium-textured soils formed from glacial till mixed with silt and volcanic ash; occur on hilly foot slopes; depth to bedrock ranges from 3 to more than 5 feet.	0 to 16 16 to 60	Silt loam Loam
BbB BbD	Bernhill silt loam, moderately shallow, 0 to 20 percent slopes. Bernhill silt loam, moderately shallow, 30 to 55 percent slopes.	Similar to Bernhill silt loam soils, except that depth to bedrock ranges from 20 to 36 inches.	0 to 12 12 to 36	Silt loam Loam
BeB	Bernhill gravelly silt loam, 0 to 20 percent slopes.	Similar to Bernhill silt loam soils, except that the surface layer is gravelly and the subsoil contains more gravel.	0 to 16 16 to 29 29 to 45 45 to 60	Gravelly silt loam Gravelly loam Gravelly heavy loam Gravelly loam
BfB BfD	Bernhill very stony silt loam, 0 to 20 percent slopes. Bernhill very stony silt loam, 20 to 55 percent slopes.	Similar to Bernhill silt loam soils, except that the surface layer is very stony.		
BhD	Bernhill soils, 20 to 55 percent slopes.	Bernhill silt loam part is similar to Bernhill silt loam, moderately shallow soils. Bernhill gravelly silt loam part is similar to Bernhill gravelly silt loam soils.		
BkC	Bernhill very rocky complex, 0 to 30 percent slopes.	Bernhill part is similar to Bernhill silt loam soils. Rock outcrop included in this complex.		
BkD	Bernhill very rocky complex, 30 to 55 percent slopes.	Bernhill part is similar to Bernhill silt loam soils. Rock outcrop included in this complex.		
BoB	Bong coarse sandy loam, 0 to 8 percent slopes.	Moderately coarse textured, somewhat excessively drained soil on nearly level outwash plains; depth to coarse sand ranges from 20 to 40 inches.	0 to 10 10 to 30 30 to 60	Coarse sandy loam Sandy loam Coarse sand

Engineering properties and interpretations of the soils

To be able to make the best use of the soil maps and the soil survey report, engineers should know the properties of the soil materials and the condition of the soils in place. Table 6 in this section contains a summary of soil properties significant in engineering, and table 7 gives engineering interpretations.

Engineering properties of the soils.—A brief description of each soil and site is given in table 6. For more detailed descriptions of the soils, see the section "Formation and Classification of Soils." Also given in this table are the USDA texture of each soil, estimates of the Unified and AASHO classifications, the percentages passing No. 4, No. 10, and No. 200 sieves, permeability rates, available water capacity, reaction, dispersion, and shrink-swell potential.

The USDA textural classification is made according to the system used by the Soil Conservation Service in soil surveys.

estimated physical and chemical properties

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
ML–CL	A–4	90 to 100	90 to 100	85 to 95	0.8 to 2.5	0.17 to 0.20	6.6 to 9.0	Moderate	Low to moderate.
ML–CL	A–4	95 to 100	95 to 100	85 to 90	0.8 to 2.5	0.17 to 0.20	6.1 to 6.5	Moderate	Low to moderate.
ML–CL	A–4	90 to 95	80 to 90	50 to 60	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
ML–CL	A–4	95 to 100	95 to 100	85 to 90	0.8 to 2.5	0.17 to 0.20	6.1 to 6.5	Moderate	Low to moderate.
ML–CL	A–4	85 to 90	80 to 90	50 to 60	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
ML–SM	A–4	60 to 90	50 to 80	45 to 65	0.8 to 2.5	0.12 to 0.14	6.1 to 6.5	Moderate	Low.
ML–SM	A–4	80 to 90	50 to 80	40 to 55	0.8 to 2.5	0.12 to 0.14	6.6 to 7.3	Moderate	Low.
CL	A–4	80 to 90	50 to 80	55 to 65	0.8 to 2.5	0.14 to 0.16	6.6 to 7.3	Low	Low to moderate.
ML–SM	A–4	80 to 90	50 to 80	40 to 55	0.8 to 2.5	0.12 to 0.14	6.6 to 7.3	Moderate	Low.
SM	A–2	95 to 100	90 to 95	15 to 25	2.5 to 5.0	0.12 to 0.14	6.6 to 7.3	High	Low.
SM	A–2	95 to 100	90 to 95	20 to 30	2.5 to 5.0	0.07 to 0.09	6.6 to 7.3	High	Low.
SP	A–3	95 to 100	90 to 95	5 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification
				USDA texture
			In.	
BpB	Bong and Phoebe fine sandy loams, 0 to 8 percent slopes.	Bong part is moderately coarse textured and somewhat excessively drained; formed in glaciofluvial material on undulating nearly level to moderately sloping areas; depth to coarse sand ranges from 20 to 30 inches. For Phoebe part, see Phoebe soils in this table.	0 to 22	Fine sandy loam
			22 to 28	Gravelly coarse sandy loam.
			28 to 60	Coarse sand
BrB	Bong and Phoebe coarse sandy loams, 0 to 20 percent slopes.	Bong part similar to Bong in Bong and Phoebe fine sandy loams, 0 to 8 percent slopes, except that the surface layer is coarse sandy loam. For Phoebe part, see Phoebe soils in this table.		
BrC	Bong and Phoebe coarse sandy loams, 20 to 30 percent slopes.			
BsB	Bong and Phoebe loamy sands, 0 to 20 percent slopes.	Bong part similar to Bong in Bong and Phoebe fine sandy loams, 0 to 8 percent slopes, except that the surface layer is loamy sand. For Phoebe part, see Phoebe soils in this table.		
BtB	Bonner silt loam, 0 to 8 percent slopes.	Moderately deep, medium-textured, well-drained soil underlain by gravel at 20 to 36 inches; formed in glacial outwash material with an admixture of silt and volcanic ash in the surface layer.	0 to 10	Silt loam
			10 to 20	Gravelly loam
			20 to 26	Gravelly coarse sandy loam.
			26 to 60	Gravelly coarse sand.
BuB	Bonner gravelly silt loam, 0 to 20 percent slopes.	Similar to Bonner silt loam, 0 to 8 percent slopes, except that the surface soil is gravelly.	0 to 10	Gravelly silt loam
			10 to 20	Gravelly loam
			20 to 26	Gravelly coarse sandy loam.
			26 to 60	Gravelly coarse sand.
BvB	Bonner loam, 0 to 20 percent slopes.	Well-drained, medium-textured soil formed in glaciofluvial material and volcanic ash on nearly level to gently sloping terraces; depth to coarse sand ranges from 18 to 36 inches.	0 to 11	Loam
			11 to 21	Light loam
			21 to 60	Coarse sand
BwB	Bonner fine sandy loam, 0 to 20 percent slopes.	Similar to Bonner loam, 0 to 20 percent slopes, except that the surface layer is fine sandy loam.		
BxD	Brickel stony loam, 20 to 55 percent slopes.	Well-drained, stony mountain meadow soil in strongly sloping to very steep mountainous areas at elevations of more than 4,000 feet; formed from weathered gneiss and an admixture of volcanic ash; depth to fractured gneiss bedrock ranges from 14 to 36 inches.	0 to 22	Stony loam
			22 to 30	Very cobbly sandy loam.
By	Bridgeson silt loam.	Very deep, poorly drained, moderately fine textured soil formed from silty alluvium in narrow bottoms along intermittent and perennial streams; depth to seasonal high water table ranges from near the surface to 3 feet.	0 to 12	Silt loam
			12 to 60	Silty clay loam
Bz	Bridgeson silt loam, drained.	Similar to Bridgeson silt loam, except that the soil is drained; depth to seasonal high water table ranges from 3 to 5 feet.		
Ca	Caldwell silt loam.	Very deep, somewhat poorly drained soil formed from alluvium from adjacent silty upland soils; depth to seasonal high water table ranges from 5 to 7 feet.	0 to 38	Silt loam
			38 to 60	Silty clay loam
CeA	Cedonia silt loam, 0 to 5 percent slopes.	Very deep, medium-textured, well-drained soils formed from calcareous glacial lake sediments, modified by silt in the upper 10 to 20 inches; occur on nearly level to moderately steep, dissected lake terraces.	0 to 12	Silt loam
CeB	Cedonia silt loam, 5 to 20 percent slopes.		12 to 33	Silt loam
CeC3	Cedonia silt loam, 20 to 30 percent slopes, severely eroded.		33 to 60	Silt loam

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
SM	A-2	95 to 100	90 to 95	20 to 35	2.5 to 5.0	0.12 to 0.15	6.6 to 7.3	High	Low.
GM-SM	A-2	70 to 90	50 to 80	10 to 20	5.0 to 10.0	0.07 to 0.10	6.6 to 7.3	High	Low.
SP	A-3	95 to 100	90 to 95	5 to 10	>10	0.05 to 0.07	6.6 to 7.3	High	Low.
ML-CL	A-4	85 to 95	80 to 95	75 to 90	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	High	Low to moderate.
SM	A-4	60 to 90	50 to 80	35 to 50	0.8 to 2.5	0.12 to 0.14	6.1 to 6.5	High	Low.
GM-SM	A-2	60 to 90	50 to 80	10 to 20	5.0 to 10	0.07 to 0.10	6.1 to 6.5	High	Low.
GM-GP	A-1	60 to 90	50 to 80	5 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
ML SM	A-4	65 to 90	50 to 80	40 to 60	0.8 to 2.5	0.12 to 0.14	6.6 to 7.3	Moderate	Low.
SM	A-4	60 to 90	50 to 80	35 to 50	0.8 to 2.5	0.12 to 0.14	6.1 to 6.5	High	Low.
GM-SM	A-2	60 to 90	50 to 80	10 to 20	5.0 to 10	0.07 to 0.10	6.1 to 6.5	High	Low.
GM-GP	A-1	60 to 90	50 to 80	5 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
ML-CL	A-4	85 to 95	80 to 95	50 to 60	0.8 to 2.5	0.17 to 0.20	6.1 to 6.5	High	Low to moderate.
SM-ML	A-4	85 to 95	80 to 95	40 to 55	0.8 to 2.5	0.14 to 0.16	6.1 to 6.5	High	Low.
SW	A-3	95 to 100	90 to 95	5 to 10	>10	0.05 to 0.07	6.6 to 7.3	High	Low.
SM	A-4	60 to 90	50 to 80	35 to 45	0.8 to 2.5	0.12 to 0.14	6.1 to 6.5	High	Low.
GM	A-2	30 to 60	20 to 50	10 to 20	5.0 to 10.0	0.07 to 0.08	6.1 to 6.5	High	Low.
ML to CL	A-4	95 to 100	90 to 100	90 to 95	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
CL	A-6	95 to 100	90 to 100	90 to 95	0.05 to 2.5	0.17 to 0.20	6.6 to 7.3	Low	Moderate.
ML-CL	A-4	95 to 100	90 to 100	85 to 90	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
CL	A-6	95 to 100	90 to 100	90 to 95	0.2 to 0.8	0.17 to 0.20	6.6 to 7.3	Low	Moderate.
ML-CL	A-4	95 to 100	95 to 100	90 to 95	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	High	Low to moderate.
ML-CL	A-4	95 to 100	95 to 100	90 to 95	0.8 to 2.5	0.17 to 0.20	[1] 7.4 to 8.4	High	Low to moderate.
ML	A-4	95 to 100	95 to 100	85 to 90	0.2 to 0.8	0.17 to 0.20	[1] 7.9 to 9.0	High	Low.

[1] This layer is calcareous.

221-715—68——6

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification
				USDA texture
			In.	
CgB	Cheney gravelly silt loam, 0 to 8 percent slopes.	Medium-textured, well-drained soil 20 to 40 inches deep to gravel; formed in glacial outwash material on nearly level to gently sloping outwash plains.	0 to 28	Gravelly silt loam
			28 to 35	Very gravelly sandy loam.
			35 to 60	Gravel and cobblestones.
ChB	Cheney stony silt loam, 0 to 20 percent slopes.	Similar to Cheney gravelly silt loam, except that the surface layer is stony.		
CkC	Cheney very rocky complex, 0 to 30 percent slopes.	Cheney part similar to Cheney gravelly silt loam, except that the surface layer is stony. Rock outcrops (basalt) and unnamed shallow soils also included in these complexes.		
CmC	Cheney extremely rocky complex, 0 to 30 percent slopes.			
CnB	Cheney and Uhlig silt loams, 0 to 8 percent slopes.	Cheney part is well-drained, medium-textured soil 20 to more than 40 inches deep to gravel; formed in glacial outwash material on nearly level to gently sloping outwash plains; the surface layer is mostly silt. For Uhlig part, see Uhlig soils in this table.	0 to 28	Silt loam
			28 to 35	Very gravelly sandy loam.
			35 to 60	Gravel and cobbles
CoB	Cheney-Uhlig complex, 0 to 8 percent slopes.	Cheney part similar to Cheney gravelly silt loam, except that the surface layer is stony. For Uhlig part, see Uhlig soils in this table.		
CsA	Clayton fine sandy loam, 0 to 5 percent slopes.	Very deep, well-drained, moderately coarse textured soils formed from glaciofluvial materials on broad, nearly level to gently sloping terraces; wavy bands of loam texture, ranging from ¼ inch to 2 inches in thickness, occur at depth of 15 to 60 inches or more; interval between bands ranges from a few inches to more than 1 foot.	0 to 9	Fine sandy loam
CsB	Clayton fine sandy loam, 5 to 20 percent slopes.		9 to 35	Sandy loam
			35 to 54	Loamy fine sand
			54 to 75	Sand
CtA	Clayton loam, 0 to 5 percent slopes.	Similar to Clayton fine sandy loam soils, except that the surface layer is loam.		
CtB	Clayton loam, 5 to 20 percent slopes.			
CuB	Clayton sandy loam, 0 to 8 percent slopes.	Similar to Clayton fine sandy loam soils, except that the surface layer is sandy loam.		
Cw	Cocolalla silty clay loam.	Poorly drained soil formed in alluvium from silt and a mixture of pumicite and diatomite in basins in the channeled scabland; depth to water table fluctuates from near the surface to 4 feet below the surface.	0 to 13	Silty clay loam
			13 to 46	Silt loam
			46 to 62	Silty clay loam or clay loam.
Cy	Cocolalla silty clay loam, drained.	Similar to Cocolalla silty clay loam, except that it is somewhat poorly drained; depth to water table fluctuates from 3 to 5 feet.		
DaA	Dearyton silt loam, 0 to 5 percent slopes.	Well drained and moderately well drained soils with a fine or moderately fine textured subsoil; parent material is glacial till from acid igneous rocks mixed with some silt and volcanic ash; occur on nearly level to hilly mountain foot slopes.	0 to 11	Silt loam
DaB	Dearyton silt loam, 5 to 20 percent slopes.		11 to 25	Loam
DaC	Dearyton silt loam, 20 to 40 percent slopes.		25 to 38	Light clay
			38 to 46	Clay loam
			46 to 60	Gravelly clay loam
DeB	Dearyton silt loam, thin solum variant, 0 to 20 percent slopes.	Similar to Dearyton silt loam soils, except that basalt, granite, gneiss, or schist bedrock occurs at a depth of 24 to 40 inches.		
DrC	Dragoon silt loam, 0 to 30 percent slopes.	Moderately deep soil formed from granite, gneiss, or schist mixed with loess and ash in upper part; depth to bedrock ranges from 20 to 40 inches.	0 to 11	Silt loam
			11 to 27	Heavy loam
			27 to 36	Coarse sandy

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
ML-SM	A-4	60 to 90	50 to 80	40 to 60	0. 8 to 2. 5	0. 12 to 0. 14	6. 6 to 7. 3	Moderate	Low.
GM	A-2	30 to 60	20 to 50	5 to 15	5. 0 to 10. 0	0. 06 to 0. 09	6. 6 to 7. 8	High	Low.
GP	A-1	25 to 35	10 to 20	0 to 5	>10	0. 04 to 0. 06	7. 4 to 8. 2	High	Low.
ML	A-4	95 to 100	90 to 95	85 to 90	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low.
GM	A-2	30 to 60	20 to 50	5 to 15	5. 0 to 10. 0	0. 06 to 0. 09	6. 6 to 7. 8	High	Low.
GP	A-1	25 to 35	10 to 20	0 to 5	>10	0. 04 to 0. 06	7. 4 to 8. 2	High	Low.
SM	A-2	95 to 100	95 to 100	25 to 35	0. 8 to 2. 5	0. 13 to 0. 15	6. 0 to 6. 5	High	Low.
SM	A-2	95 to 100	95 to 100	20 to 30	0. 8 to 2. 5	[2] 0. 17 to 0. 20	6. 1 to 6. 6	High [3]	Low.
SM	A-2	95 to 100	90 to 95	10 to 20	2. 5 to 5. 0	[2] 0. 17 to 0. 20	6. 6 to 7. 3	High [3]	Low.
SP	A-3	95 to 100	90 to 95	0 to 10	2. 5 to 5. 0	0. 12 to 0. 14	6. 6 to 7. 3	High	Low.
CL	A-6	95 to 100	95 to 100	85 to 95	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 8	Low	Moderate.
ML-CL	A-4	95 to 100	95 to 100	85 to 95	0. 8 to 2. 5	0. 17 to 0. 20	7. 4 to 7. 8	High	Low to moderate.
CL	A 6	95 to 100	95 to 100	90 to 95	0. 2 to 0. 8	0. 17 to 0. 20	7. 4 to 7. 8	Low	Moderate.
ML-CL	A-4	95 to 100	90 to 100	90 to 95	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low to moderate.
ML-CL	A-4	95 to 100	90 to 100	50 to 60	0. 8 to 2. 5	0. 17 to 0. 20	6. 1 to 6. 6	Moderate	Low to moderate.
CH	A-7	95 to 100	70 to 100	70 to 95	0. 05 to 0. 2	0. 14 to 0. 17	6. 6 to 7. 3	Low	High.
CL	A-6	90 to 100	70 to 100	70 to 95	0. 2 to 0. 8	0. 17 to 0. 20	6. 6 to 7. 3	Low	Moderate.
CL	A-6	90 to 100	50 to 80	50 to 60	0. 2 to 0. 8	0. 14 to 0. 17	6. 6 to 7. 3	Low	Moderate.
ML-CL	A-4	95 to 100	95 to 100	85 to 95	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low to moderate.
ML to CL	A-4 to A-6	95 to 100	80 to 90	50 to 60	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Low	Low to moderate.
SM	A-2	90 to 100	85 to 95	15 to 25	2. 5 to 5. 0	0. 10 to 0. 12	6. 6 to 7. 3	High	Low.

[2] Increase in capacity in these layers is attributable to the bands of loamy material.
[3] Moderate in bands of loamy material.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification: USDA texture
			In.	
DsC	Dragoon stony silt loam, 0 to 30 percent slopes.	Similar to Dragoon silt loam, 0 to 30 percent slopes, except that the surface layer is stony.		
DsD	Dragoon stony silt loam, 30 to 55 percent slopes.			
DvD	Dragoon very rocky complex, 20 to 55 percent slopes.	Dragoon part similar to Dragoon silt loam, 0 to 30 percent slopes, except that depth to bedrock ranges from 10 to 20 inches. Rock outcrop included in this complex.		
EkB	Eloika silt loam, 0 to 20 percent slopes.	Medium-textured, well-drained soil formed from glacial till containing a large amount of volcanic ash in the surface layer; underlain by gravel at depth of 30 to 60 inches; occupies undulating, morainelike topography.	0 to 24	Silt loam
			24 to 44	Gravelly loam
			44 to 53	Very gravelly sandy loam.
			53 to 60	Gravel
ElC	Eloika very stony silt loam, 0 to 30 percent slopes.	Similar to Eloika silt loam, 0 to 20 percent slopes, except that they are very stony throughout.		
ElD	Eloika very stony silt loam, 30 to 55 percent slopes.			
Em	Emdent silt loam.	Medium-textured, somewhat poorly drained, alkaline soil formed in alluvium from calcareous silt, volcanic ash, and diatomite; depth to water table fluctuates from near the surface to about 6 feet.	0 to 26	Silt loam
			26 to 41	Very fine sandy loam.
			41 to 60	Sandy clay loam
FaB	Freeman silt loam, 5 to 20 percent slopes.	Very deep, moderately well drained upland soils with medium-textured surface layer and medium or moderately fine textured subsoil; formed from silt on rolling to hilly uplands.	0 to 22	Silt loam
FaB3	Freeman silt loam, 5 to 20 percent slopes, severely eroded.		22 to 72	Silty clay loam
FaC3	Freeman silt loam, 20 to 30 percent slopes, severely eroded.			
Fm	Fresh water marsh.	Shallow, swampy, intermittent ponds and fringes around lakes that have a fluctuating water table. Engineering data is not given, as land type is too variable.		
GaC3	Garfield silty clay loam, 0 to 30 percent slopes, severely eroded.	Very deep, well-drained soil developed in loess on ridgetops and knobs on the rolling to hilly uplands in the Palouse soil area.	0 to 8	Silty clay loam
			8 to 23	Silty clay
			23 to 60	Silty clay loam
GgA	Garrison gravelly loam, 0 to 5 percent slopes.	Gravelly, medium-textured, somewhat excessively drained soils formed in gravelly glacial outwash material from a variety of acid, igneous parent rock; on nearly level to moderately sloping terraces; depth to mixture of sand, gravel, and cobblestones ranges from 2½ to 5 feet.	0 to 15	Gravelly loam
GgB	Garrison gravelly loam, 5 to 20 percent slopes.		15 to 44	Very gravelly loam
			44 to 60	Sand, gravel, and cobblestones.
GmB	Garrison very gravelly loam, 0 to 8 percent slopes.	Similar to Garrison gravelly loam, except that the surface layer is very gravelly.	0 to 15	Very gravelly loam
			15 to 44	Very gravelly loam
			44 to 60	Sand, gravel, and cobblestones.
GnB	Garrison very stony loam, 0 to 20 percent slopes.	Similar to Garrison gravelly loam, except that the surface layer is very stony.		
GpA	Glenrose silt loam, 0 to 5 percent slopes.	Very deep, medium-textured, well-drained soils formed from acid igneous glacial till; surface layer influenced by loess and volcanic ash; on gently rolling to steep uplands.	0 to 72	Silt loam
GpB	Glenrose silt loam, 5 to 20 percent slopes.			
GpC	Glenrose silt loam, 20 to 30 percent slopes.			
GpD	Glenrose silt loam, 30 to 55 percent slopes.			

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
ML-CL	A-4	85 to 95	80 to 95	60 to 70	0.8 to 2.5	0.17 to 0.20	6.1 to 6.5	High	Low to moderate.
SM	A-4	75 to 85	40 to 80	35 to 50	0.8 to 2.5	0.12 to 0.14	6.1 to 6.6	High	Low.
GM	A-2	30 to 60	20 to 50	5 to 15	5.0 to 10.0	0.06 to 0.09	6.1 to 7.3	High	Low.
GP	A-1	25 to 35	10 to 20	0 to 5	>10	0.04 to 0.06	6.6 to 7.3	High	Low.
ML-CL	A-4	95 to 100	90 to 100	90 to 95	0.8 to 2.5	0.17 to 0.20	7.8 to 9.0	High	Low to moderate.
ML	A-4	95 to 100	90 to 100	60 to 70	0.8 to 2.5	0.17 to 0.20	7.4 to 8.4	Moderate	Low.
CL	A-6	95 to 100	90 to 95	85 to 90	0.2 to 0.8	0.17 to 0.20	6.6 to 7.3	Low	Moderate.
ML-CL	A-4	95 to 100	90 to 100	80 to 90	0.2 to 0.8	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
CL	A-6	95 to 100	90 to 100	80 to 90	<0.05	0.17 to 0.20	6.6 to 7.3	Low	Moderate.
CL	A-6	95 to 100	90 to 100	90 to 95	0.2 to 0.8	0.17 to 0.16	6.6 to 7.3	Low	Moderate.
CH	A-7	95 to 100	90 to 100	90 to 95	0.05 to 0.2	0.14 to 0.17	6.6 to 7.3	Low	High.
CL	A-6	95 to 100	90 to 100	90 to 95	0.2 to 2.5	0.17 to 0.20	6.6 to 7.3	Low	Moderate.
SM	A-4	65 to 85	40 to 80	35 to 50	0.8 to 2.5	0.12 to 0.14	6.6 to 7.3	Moderate	Low.
GM	A-2	45 to 65	30 to 60	5 to 15	2.5 to 5.0	0.08 to 0.10	6.6 to 7.3	Moderate	Low.
GP	A-1	25 to 35	10 to 20	0 to 5	>10	0.04 to 0.06	6.6 to 7.3	High	Low.
GM	A-2	30 to 60	20 to 50	5 to 15	2.5 to 5.0	0.08 to 0.10	6.1 to 6.6	Moderate	Low.
GM	A-2	45 to 65	30 to 60	5 to 15	2.5 to 5.0	0.08 to 0.10	6.6 to 7.3	Moderate	Low.
GP	A-1	25 to 35	10 to 20	0 to 5	>10	0.04 to 0.06	6.6 to 7.3	High	Low.
ML-CL	A-4	80 to 95	75 to 95	60 to 85	0.8 to 2.5	0.17 to 0.20	6.1 to 7.3	Moderate	Low to moderate.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification: USDA texture
			In.	
GrB	Glenrose gravelly silt loam, 5 to 20 percent slopes.	Similar to Glenrose silt loam soils, but gravelly throughout.	0 to 72	Gravelly silt loam
GrD	Glenrose gravelly silt loam, 20 to 55 percent slopes.			
GsD	Glenrose stony silt loam, 20 to 55 percent slopes.	Similar to Glenrose silt loam soils, except that the surface layer is stony.		
GtA	Green Bluff silt loam, 0 to 5 percent slopes.	Very deep, medium-textured, moderately well drained soils formed from acid igneous glacial till; surface layer contains an admixture of silt and volcanic ash; occur on undulating to rolling upland plateaus.	0 to 33	Silt loam
GtB	Green Bluff silt loam, 5 to 20 percent slopes.		33 to 60	Very fine sandy loam and gravelly silt loam.
HfC	Hagen loamy fine sand, 0 to 30 percent slopes.	Very deep, somewhat excessively drained, coarse-textured soil formed from wind-worked sandy glacial outwash materials of acid igneous origin; in undulating dunelike areas.	0 to 38	Loamy fine sand and loamy sand.
			38 to 60	Sand
HgB	Hagen sandy loam, 0 to 20 percent slopes.	Similar to Hagen loamy fine sand, 0 to 30 percent slopes, except that the surface layer is a sandy loam.	0 to 11	Sandy loam
			11 to 38	Loamy sand
			38 to 60	Sand
HhA	Hardesty silt loam, 0 to 5 percent slopes.	Very deep, moderately well drained, medium-textured soil formed from volcanic ash; occur on nearly level to gently sloping areas, commonly in small bodies at the toe of terrace breaks or rock ledges.	0 to 39	Silt loam
			39 to 60	Loamy very fine sand.
HmA	Hardesty silt loam, moderately shallow, 0 to 5 percent slopes.	Similar to Hardesty silt loam, 0 to 5 percent slopes, except that the depth to coarse sand, gravel, or bedrock ranges from 20 to 36 inches.		
HnB	Hesseltine silt loam, 0 to 10 percent slopes.	Shallow, medium-textured, well-drained soil underlain at depth of 12 to 20 inches by a mixture of sand, gravel, and cobblestones or by basalt bedrock; on gently sloping to moderately sloping outwash plains.	0 to 13	Silt loam
			13 to 17	Gravelly loam
			17 to 36	Very gravelly and stony coarse sandy loam.
			36 to 60	Gravel, cobblestones, and stones.
HoB	Hesseltine silt loam, moderately deep, 0 to 8 percent slopes.	Similar to Hesseltine silt loam, 0 to 10 percent slopes, except that the depth to open coarse sand, gravel, and cobblestones or bedrock is 20 to 36 inches.		
HrB	Hesseltine gravelly silt loam, 0 to 10 percent slopes.	Similar to Hesseltine silt loam, 0 to 10 percent slopes, except that the surface layer is gravelly.	0 to 17	Gravelly silt loam
			17 to 36	Very gravelly and stony coarse sandy loam.
			36 to 60	Gravel, cobblestones, and stones.
HsB	Hesseltine stony silt loam, 0 to 20 percent slopes.	Similar to Hesseltine silt loam, 0 to 10 percent slopes, except that the surface layer is stony.		
HtB	Hesseltine stony silt loam, mounded, 0 to 8 percent slopes.	Stony part similar to Hesseltine stony silt loam, 0 to 20 percent slopes. Mounds similar to Hesseltine silt loam, moderately deep, 0 to 8 percent slopes.		
HvC	Hesseltine very rocky complex, 0 to 30 percent slopes.	Hesseltine part similar to Hesseltine silt loam, 0 to 10 percent slopes. Rock outcrop (basalt) and unnamed very shallow soils included in this complex.		
HvD	Hesseltine very rocky complex, 30 to 55 percent slopes.			
HxC	Hesseltine extremely rocky complex, 0 to 30 percent slopes.			

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
ML-SM	A-4	60 to 90	50 to 80	45 to 65	0.8 to 2.5	0.12 to 0.14	6.6 to 7.3	Moderate	Low.
ML-CL	A-4	90 to 100	80 to 90	75 to 85	0.8 to 2.5	0.17 to 0.20	6.1 to 6.6	High	Low to moderate.
ML-SM	A-4	80 to 95	75 to 90	45 to 65	0.8 to 2.5	0.14 to 0.20	6.1 to 6.5	High	Low.
SM	A-2	90 to 100	90 to 95	10 to 20	5.0 to 10.0	0.07 to 0.12	6.1 to 6.6	High	Low.
SW	A-3	95 to 100	90 to 95	0 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
SM	A-2	95 to 100	95 to 100	20 to 30	2.5 to 5.0	0.12 to 0.14	6.1 to 6.6	High	Low.
SM	A-2	95 to 100	90 to 95	5 to 15	5.0 to 10.0	0.07 to 0.09	6.1 to 7.3	High	Low.
SW	A-3	95 to 100	90 to 95	0 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
ML	A-4	95 to 100	95 to 100	55 to 65	0.8 to 2.5	0.17 to 0.20	6.1 to 7.3	High	Low.
SM	A-2	90 to 100	90 to 100	15 to 25	5.0 to 10.0	0.12 to 0.14	6.6 to 7.3	High	Low.
ML to CL	A-4	90 to 100	90 to 95	70 to 80	0.8 to 2.5	0.17 to 0.20	6.1 to 7.3	Moderate	Low to moderate.
ML-SM	A-4	80 to 90	50 to 80	45 to 55	0.8 to 2.5	0.12 to 0.14	6.6 to 7.3	Moderate	Low.
GW-GM	A-2	30 to 60	20 to 50	10 to 20	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
GW	A-1	30 to 60	20 to 50	5 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
ML-SM	A-4	60 to 90	50 to 80	45 to 65	0.8 to 2.5	0.12 to 0.14	6.1 to 7.3	Moderate	Low.
GW-GM	A-2	30 to 60	20 to 50	10 to 20	>10	0.04 to 0.07	6.6 to 7.3	High	Low.
GW	A-1	30 to 60	20 to 50	5 to 10	>10	0.04 to 0.07	6.6 to 7.3	High	Low.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification: USDA texture
			In.	
Kc	Konner silty clay loam.	Very deep, poorly drained, moderately fine textured soil formed from recent alluvium on nearly level stream bottoms and on perimeters of lakes and bogs; parent material derived from lake-bed clay, granite, schist, gneiss, volcanic ash, and diatomite; depth to seasonal high water table ranges from 18 to 30 inches.	0 to 60	Silty clay loam
Kd	Konner silty clay loam, drained.	Similar to Konner silty clay loam, except that it is somewhat poorly drained and depth to seasonally high water table ranges from 40 to 60 inches.		
LaB LaD	Lakesol silt loam, 0 to 20 percent slopes. Lakesol silt loam, 20 to 55 percent slopes.	Very deep, well-drained, medium-textured soils formed in glacial lake sediments that contained a mixture of silt and volcanic ash in the surface layer; occur on gently to strongly sloping, dissected lake terraces.	0 to 65	Silt loam
LeA LeB	Laketon silt loam, 0 to 5 percent slopes. Laketon silt loam, 5 to 20 percent slopes.	Very deep, moderately well drained, medium-textured soils formed from silty glaciofluvial material and volcanic ash; occur on smooth to gently undulating nearly level terraces.	0 to 32 32 to 60	Silt loam Silty clay loam
LfA	Laketon fine sandy loam, 0 to 5 percent slopes.	Similar to Laketon silt loam soils, except that the surface layer is a fine sandy loam.	0 to 10 10 to 32 32 to 60	Fine sandy loam Silt loam Silty clay loam
LmC	Lance silt loam, 0 to 30 percent slopes.	Very deep, well-drained, medium-textured soil formed from calcareous silt on upper slopes and ridgetops of rolling to hilly uplands; in places caliche is present at a moderate depth. Data also applies to Lance part of Athena-Lance silt loams, 0 to 30 percent slopes.	0 to 22 22 to 40 40 to 60	Silt loam Silty clay loam Silt loam
LmC3	Lance silt loam, 0 to 30 percent slopes, severely eroded.	Similar to Lance silt loam, 0 to 30 percent slopes, except that the surface layer is eroded. Lance part of Athena-Lance silt loams, 30 to 55 percent slopes, also similar but has eroded surface layer.		
LnA2 LnB2 LnD2	Larkin silt loam, 0 to 5 percent slopes, eroded. Larkin silt loam, 5 to 20 prcent slopes, eroded. Larkin silt loam, 20 to 45 percent slopes, eroded.	Very deep, well-drained, medium-textured soils formed from silt on rolling to hilly uplands.	0 to 72	Silt loam
Lt	Latah silt loam.	Very deep, somewhat poorly drained or poorly drained alluvial soil on nearly level bottoms along intermittent drainageways in the Naff soil area; depth to seasonal high water table may range from 2 to 4 feet.	0 to 8 8 to 38 38 to 45 45 to 60	Silt loam Silty clay loam Silty clay Silty clay loam
MaC	Marble loamy sand, 0 to 30 percent slopes.	Very deep, excessively drained, coarse-textured soil formed from sandy glaciofluvial material on dunelike, nearly level to steep terraces and terrace breaks.	0 to 6 6 to 60	Loamy sand Coarse sand
MbC	Marble loamy coarse sand, 0 to 30 percent slopes.	Very deep, coarse-textured, excessively drained soil formed from wind-worked sandy glaciofluvial material on gently sloping to rolling dunelike topography.	0 to 13 13 to 60	Loamy coarse sand Sand

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
CL	A-6	95 to 100	95 to 100	90 to 95	0. 05 to 0. 8	0. 17 to 0. 20	6. 6 to 7. 3	Low	Moderate.
ML-CL	A-4	95 to 100	95 to 100	85 to 90	0. 2 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low to moderate.
ML-CL	A-4	95 to 100	95 to 100	85 to 90	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low to moderate.
CL	A-6	95 to 100	95 to 100	90 to 95	0. 2 to 0. 8	0. 17 to 0. 20	6. 1 to 6. 5	Low to moderate.	Moderate.
SM	A-2	95 to 100	95 to 100	25 to 35	0. 8 to 2. 5	0. 13 to 0. 15	6. 6 to 7. 3	Low	Low.
ML-CL	A-4	95 to 100	95 to 100	85 to 90	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low to moderate.
CL	A-6	95 to 100	95 to 100	90 to 95	0. 2 to 0. 8	0. 17 to 0. 20	6. 1 to 6. 5	Low to moderate.	Moderate.
ML-CL	A-4	95 to 100	90 to 100	85 to 90	0. 8 to 2. 5	0. 17 to 0. 20	[1] 8. 4 to 9. 0	High	Low to moderate.
CL	A-6	95 to 100	90 to 100	85 to 95	0. 2 to 0. 8	0. 17 to 0. 20	[1] 8. 6 to 9. 0	High	Moderate.
ML-CL	A-4	95 to 100	90 to 100	85 to 90	0. 8 to 2. 5	0. 17 to 0. 20	[1] 7. 9 to 8. 4	High	Low to moderate.
ML to CL	A-4 to A-6.	95 to 100	90 to 100	80 to 90	0. 8 to 2. 5	0. 17 to 0. 20	6. 1 to 7. 3	Moderate	Low to moderate.
ML-CL	A-4	95 to 100	90 to 100	85 to 95	0. 8 to 2. 5	0. 17 to 0. 20	6. 1 to 6. 6	Moderate	Low to moderate.
CL	A-6	95 to 100	90 to 100	90 to 95	0. 2 to 0. 8	0. 17 to 0. 20	6. 1 to 6. 6	Moderate to low.	Moderate.
CH	A-7	95 to 100	90 to 100	90 to 95	<0. 05	0. 14 to 0. 17	6. 6 to 7. 3	Low	High.
CL	A-6	95 to 100	90 to 100	90 to 95	0. 05 to 0. 2	0. 17 to 0. 20	6. 6 to 7. 3	Low	Moderate.
SM	A-1	95 to 100	90 to 100	5 to 15	5. 0 to 10. 0	0. 17 to 0. 08	6. 1 to 6. 6	High	Low.
SP	A-3	95 to 100	90 to 100	0 to 10	>10	0. 04 to 0. 07	6. 6 to 7. 3	High	Low.
SM	A-2	95 to 100	80 to 90	10 to 20	5. 0 to 10. 0	0. 07 to 0. 08	6. 1 to 6. 5	High	Low.
SP	A-3	95 to 100	90 to 100	0 to 10	>10	0. 04 to 0. 07	6. 6 to 7. 3	High	Low.

[1] This layer is calcareous.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification
				USDA texture
			In.	
McB	Marble sandy loam, 0 to 8 percent slopes.	Deep and moderately deep, moderately coarse textured, somewhat excessively drained soil formed from sandy glaciofluvial material; soil is underlain by thick beds of coarse sand.	0 to 23	Sandy loam
			23 to 60	Coarse sand
Md	Mondovi silt loam.	Very deep, medium-textured, well-drained alluvial soil.	0 to 60	Silt loam
MmC	Moscow silt loam, 0 to 30 percent slopes.	Moderately deep, well-drained, medium-textured soils formed from granite, gneiss, or schist on hilly and mountainous uplands; surface layer contains considerable volcanic ash; bedrock at depth of about 27 inches.	0 to 13	Silt loam
MmD	Moscow silt loam, 30 to 55 percent slopes.		13 to 27	Loam
MoC	Moscow silt loam, shallow, 0 to 30 percent slopes.	Similar to Moscow silt loam soils, except that depth to bedrock is about 20 inches.		
MoD	Moscow silt loam, shallow, 30 to 55 percent slopes.			
MsC	Moscow very rocky complex, 0 to 30 percent slopes.	Moscow part similar to shallow Moscow silt loam soils. Rock outcrop included in these complexes.		
MsE	Moscow very rocky complex, 30 to 70 percent slopes.			
NaA	Naff silt loam, 0 to 5 percent slopes.	Very deep, well-drained soils formed from loess on rolling to hilly uplands.	0 to 26	Silt loam
NaA2	Naff silt loam, 0 to 5 percent slopes, eroded.		26 to 60	Light silty clay loam.
NaC	Naff silt loam, 5 to 30 percent slopes.			
NaC2	Naff silt loam, 5 to 30 percent slopes, eroded.			
NaC3	Naff silt loam, 0 to 30 percent slopes, severely eroded.			
NaD2	Naff silt loam, 30 to 45 percent slopes, eroded.			
NcA	Narcisse silt loam, 0 to 5 percent slopes.	Very deep, medium-textured, moderately well drained recent alluvial soil in narrow valleys along intermittent and perennial streams in the mountains and foothills; depth to water table may fluctuate from 3 to more than 5 feet; surface layer gravelly in places.	0 to 25	Silt loam
			25 to 34	Very fine sandy loam.
			34 to 62	Fine sandy loam
NpA	Nez Perce silt loam, 0 to 5 percent slopes	Moderately well drained claypan soils formed from loess on nearly level to rolling hilly uplands.	0 to 18	Silt loam
NpB	Nez Perce silt loam, 5 to 20 percent slopes.		18 to 27	Very fine sandy loam.
NpB3	Nez Perce silt loam, 5 to 20 percent slopes, severely eroded.		27 to 66	Silty clay
PaB	Palouse silt loam, moderately shallow, 0 to 20 percent slopes.	Moderately shallow, well-drained soils formed from loess under grass cover on nearly level to moderately sloping uplands; basalt bedrock at depth of 20 to 36 inches.	0 to 29	Silt loam
PaC	Palouse silt loam, moderately shallow, 20 to 30 percent slopes.			
PbC2	Palouse silt loam, 5 to 30 percent slopes, eroded.	Similar to Palouse silt loam, moderately shallow, 0 to 20 percent slopes, except that depth to bedrock is more than 60 inches and 6 to 12 inches of the original surface layer has been removed by erosion.		
PcC	Palouse very rocky complex, 0 to 30 percent slopes.	Palouse part similar to Palouse silt loams, moderately shallow. Rock outcrop (basalt) and unnamed very shallow soils included in these complexes.		
PcE	Palouse very rocky complex, 30 to 70 percent slopes.			
PeA	Peone silt loam, 0 to 5 percent slopes.	Poorly drained, stratified, medium-textured recent alluvial soil formed in mixed alluvium derived from loess, pumicite, lacustrine material, acid igneous rocks, and basic igneous rocks; occurs on nearly level bottom lands along intermittent and perennial streams.	0 to 30	Silt loam high in pumicite.
			30 to 42	Very fine sandy loam high in pumicite.
			42 to 60	Loamy coarse sand

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
SM	A-2	95 to 100	90 to 95	20 to 35	2.5 to 5.0	0.12 to 0.14	6.1 to 6.5	High	Low.
SP	A-3	95 to 100	90 to 100	0 to 10	>10	0.04 to 0.07	6.1 to 6.5	High	Low.
ML-CL	A-4	95 to 100	90 to 100	80 to 90	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
ML-CL	A-4	90 to 100	90 to 100	85 to 90	0.8 to 2.5	0.17 to 0.20	5.6 to 6.0	High	Low to moderate.
ML-CL	A-4	95 to 100	85 to 90	50 to 60	2.5 to 5.0	0.14 to 0.17	5.0 to 5.5	High	Low to moderate.
ML-CL	A-4	95 to 100	95 to 100	85 to 90	0.8 to 2.5	0.17 to 0.20	6.1 to 6.5	Moderate	Low to moderate
CL	A-6	95 to 100	95 to 100	85 to 90	0.2 to 0.8	0.17 to 0.20	6.6 to 7.3	Moderate to low.	Moderate.
ML-CL	A-4	95 to 100	90 to 95	80 to 90	0.8 to 2.5	0.17 to 0.20	6.1 to 7.3	High	Low to moderate.
SM-ML	A-4	95 to 100	90 to 95	45 to 55	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	High	Low.
SM	A-2	95 to 100	90 to 95	25 to 35	2.5 to 5.0	0.14 to 0.17	6.6 to 7.3	High	Low.
ML-CL	A-4	95 to 100	95 to 100	85 to 90	0.2 to 0.8	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
SM-ML	A-4	95 to 100	95 to 100	45 to 55	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Low	Low.
CH	A-7	95 to 100	95 to 100	90 to 95	0.05 to 0.2	0.14 to 0.17	7.2 to 7.8	Low	High.
CL	A-4	95 to 100	90 to 100	90 to 95	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Moderate.
ML-CL	A-4	95 to 100	90 to 95	80 to 90	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	High	Low to moderate.
SM-ML	A-4	95 to 100	90 to 95	45 to 55	0.8 to 2.5	0.17 to 0.20	6.1 to 6.5	High	Low.
SP	A-3	95 to 100	90 to 95	0 to 10	>10	0.08 to 0.09	6.1 to 6.5	High	Low.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification: USDA texture
			In.	
PoA	Peone silt loam, drained, 0 to 5 percent slopes.	Similar to Peone silt loam, 0 to 5 percent slopes, except that it is somewhat poorly drained.		
PsA PsB	Phoebe sandy loam, 0 to 5 percent slopes. Phoebe sandy loam, 5 to 20 percent slopes.	Very deep, well-drained and somewhat excessively drained soils on nearly level to gently sloping outwash terraces. Data also applies to Phoebe part of Bong and Phoebe undifferentiated groups (BpB, BrB, BrC, BsB) except for texture of surface layer.	0 to 34 34 to 44 44 to 60	Sandy loam Loamy sand Sand
RdA RdB	Reardan silt loam, 0 to 5 percent slopes. Reardan silt loam, 5 to 20 percent slopes.	Very deep, well-drained claypan soils formed from loess on rolling uplands.	0 to 20 20 to 33 33 to 60	Silt loam Light silty clay Silt loam
RdB2 RdC2	Reardan silt loam, 5 to 20 percent slopes, eroded. Reardan silt loam, 20 to 30 percent slopes, eroded.	Similar to Reardan silt loam, 0 to 5 percent slopes, except that 30 to 60 percent of the original surface layer has been removed by erosion.		
Rh	Riverwash.	This unit occurs on low bottoms along perennial and intermittent streams; consists of gravel, cobblestones, and stones, with very little finer interstitial material; flooded every year during the runoff season. Engineering data is not given, as land type is too variable.		
Ro	Rock outcrop.	This unit is more than 90 percent granite, gneiss, schist, or basalt outcrops. Engineering data are not given, as land type is too variable.		
SaB SaB2 SaC SaC2 SaD	Schumacher silt loam, 0 to 20 percent slopes. Schumacher silt loam, 0 to 20 percent slopes, eroded. Schumacher silt loam, 20 to 30 percent slopes. Schumacher silt loam, 20 to 30 percent slopes, eroded. Schumacher silt loam, 30 to 55 percent slopes.	Deep, well-drained soils formed in quartzite, soft sandstone, or shale, mixed with loess and volcanic ash in upper part; depth to quartzite, shale, or soft sandstone ranges from 40 to 80 inches. The eroded Schumacher silt loam is similar to the uneroded Schumacher silt loams, except that 30 to 50 percent of the surface layer has been removed by erosion.	0 to 11 11 to 53 53 to 72	Silt loam Gravelly silt loam and gravelly heavy loam. Gravelly clay loam
ScC ScC2 ScD ScD2	Schumacher gravelly silt loam, 5 to 30 percent slopes. Schumacher gravelly silt loam, 5 to 30 percent slopes, eroded. Schumacher gravelly silt loam, 30 to 55 percent slopes. Schumacher gravelly silt loam, 30 to 55 percent slopes, eroded.	The uneroded Schumacher gravelly silt loams are similar to Schumacher silt loams, except that 15 to 20 percent of the surface layer is gravel. The eroded Schumacher gravelly silt loams are also similar to Schumacher silt loams, except that the surface layer is gravelly and 30 to 50 percent of it has been removed by erosion.		
Se	Semiahmoo muck.	Similar to Semiahmoo muck, drained, except that it is very poorly drained; water table stays within 1 foot of the surface. Engineering data not applicable.		
Sk	Semiahmoo muck, drained.	Very deep, poorly drained, organic soil developed from tules, reeds, and sedges in basins, former lakes, and swamps; water table fluctuates from 12 to 48 inches below the surface.	0 to 17 17 to 62	Muck Peat
Sm	Semiahmoo muck, moderately shallow, drained.	Similar to Semiahmoo muck, drained, except that it is moderately shallow to bedrock, mineral soil, or thick compact layers of pumicite.		
SnA SnC	Snow silt loam, 0 to 5 percent slopes. Snow silt loam, 5 to 30 percent slopes.	Very deep, well-drained, medium-textured soils formed from recent alluvium and loess.	0 to 60	Silt loam

estimated physical and chemical properties—Continued

Classification—Continued: Unified	AASHO	Percentage passing sieve—: No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
					In. per hr.	*In. per in. of soil*	*pH*		
SM	A-2	95 to 100	90 to 100	20 to 35	2.5 to 5.0	0.12 to 0.14	6.1 to 7.3	High	Low.
SM	A-2-4	90 to 100	90 to 95	5 to 15	5.0 to 10.0	0.08 to 0.12	6.6 to 7.3	High	Low.
SP	A-3	90 to 100	90 to 95	0 to 10	>10	0.05 to 0.08	6.6 to 7.3	High	Low.
ML-CL	A-4	95 to 100	95 to 100	85 to 95	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.
CL-CH	A-6 to A-7.	95 to 100	95 to 100	85 to 90	0.05 to 0.2	0.14 to 0.17	6.6 to 7.3	Low	High.
ML-CL	A-4	95 to 100	95 to 100	85 to 90	0.08 to 2.5	0.17 to 0.20	7.9 to 8.4	Low	Low to moderate
ML-CL	A-4	95 to 100	85 to 95	60 to 70	0.8 to 2.5	0.17 to 0.20	5.6 to 6.0	Moderate	Low to moderate.
ML-SM	A-4	90 to 100	50 to 80	40 to 55	0.8 to 2.5	0.14 to 0.17	5.6 to 6.0	Moderate	Low.
CL	A-6	80 to 90	50 to 80	50 to 60	0.8 to 2.5	0.14 to 0.17	6.6 to 7.3	Low	Moderate.
Pt					0.8 to 2.5	0.30 to 0.40	5.6 to 6.0	Moderate	
Pt					0.8 to 2.5	0.40 to 0.50	5.6 to 6.0	Low	
ML-CL	A-4	95 to 100	95 to 100	85 to 95	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification
				USDA texture
			In.	
SoE	Speigle very stony silt loam, 30 to 70 percent slopes.	Very deep, well-drained, medium-textured very stony soil; parent material consists of loess, volcanic ash, and local colluvium.	0 to 60	Very stony silt loam to very cobbly loam.
SpC SpD	Spokane loam, 0 to 30 percent slopes. Spokane loam, 30 to 55 percent slopes.	Well-drained, moderately coarse textured soils formed from granite, gneiss, schist, or acid igneous glacial till; depth to bedrock ranges from 30 to 60 inches.	0 to 17 17 to 25	Loam to gravelly sandy loam. Gravelly coarse loamy sand.
SrC SrE	Spokane stony loam, 0 to 30 percent slopes. Spokane stony loam, 30 to 70 percent slopes.	Similar to Spokane loam soils, except that the surface layer is 20 to 50 percent stones.		
SsC SsE	Spokane complex, 0 to 30 percent slopes. Spokane complex, 30 to 70 percent slopes.	Spokane loam, moderately shallow, part similar to Spokane loam soils, except that the depth to bedrock is between 20 and 30 inches. Spokane loam part is similar to Spokane loam soils.		
StC StE SuE	Spokane very rocky complex, 0 to 30 percent slopes. Spokane very rocky complex, 30 to 70 percent slopes. Spokane extremely rocky complex, 20 to 70 percent slopes.	Spokane loam, moderately shallow, part similar to Spokane loam soils, except that the depth to bedrock is between 20 and 30 inches. Rock outcrop included in these very rocky complexes.		
SwB	Springdale gravelly sandy loam, 0 to 20 percent slopes.	Somewhat excessively drained, gravelly, moderately coarse textured soil developed from glacial outwash of acid igneous origin; occurs on nearly level to gently sloping glacial outwash terraces.	0 to 12 12 to 46	Gravelly coarse sandy loam. Gravelly coarse sand.
SxB	Springdale gravelly sandy loam, deep, 0 to 20 percent slopes.	Similar to Springdale gravelly sandy loam, 0 to 20 percent slopes, except that the depth to gravel and coarse sand is more than 36 inches.		
SyB	Springdale cobbly sandy loam, 0 to 20 percent slopes.	Similar to Springdale gravelly sandy loam, 0 to 20 percent slopes, except that the surface layer is cobbly.		
SzE	Springdale gravelly loamy sand, 30 to 70 percent slopes.	Somewhat excessively drained, gravelly, coarse-textured soil on terrace breaks and steep slopes of major drainageways; parent material dominantly acid igneous rock.	0 to 17 17 to 60	Gravelly loamy sand. Very gravelly coarse sand.
TeB TeC TeD	Tekoa gravelly silt loam, 5 to 20 percent slopes. Tekoa gravelly silt loam, 20 to 30 percent slopes. Tekoa gravelly silt loam, 30 to 55 percent slopes.	Moderately deep, medium-textured, well-drained, gravelly soils developed from sandstone, quartzite, schist, or shale on hilly to mountainous uplands; depth to sandstone bedrock ranges from 24 to 50 inches.	0 to 20 20 to 38	Gravelly silt loam ... Very gravelly loam..
TkD	Tekoa very rocky complex, 25 to 55 percent slopes.	Tekoa part similar to Tekoa gravelly silt loam soils. Rock outcrop included in this complex.		
UhA UhB	Uhlig silt loam, 0 to 5 percent slopes. Uhlig silt loam, 5 to 20 percent slopes.	Deep, medium-textured, well-drained soils formed from glacial till mixed with loess and volcanic ash in the upper parts. Data also applies to Uhlig part of Cheney and Uhlig silt loams (CnB) and of Cheney-Uhlig complex (CoB).	0 to 60	Silt loam to very fine sandy loam.
UmC	Uhlig silt loam, moderately shallow, 5 to 30 percent slopes.	Similar to Uhlig silt loam, 5 to 20 percent slopes, except that depth to bedrock ranges from 30 to 40 inches.		

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
GM	A-2	30 to 60	20 to 50	10 to 25	0.8 to 2.5	0.08 to 0.10	6.6 to 7.3	Moderate	Low.
GM-SM	A-2	85 to 95	50 to 80	15 to 20	0.8 to 2.5	0.08 to 0.10	6.1 to 6.5	High	Low.
GM-GP	A-1	70 to 80	50 to 80	5 to 10	5.0 to 10.0	0.04 to 0.07	6.6 to 7.3	High	Low.
SM	A-1	70 to 80	50 to 80	10 to 20	5.0 to 10.0	0.07 to 0.10	5.6 to 6.0	High	Low.
GM-GP	A-1	65 to 75	50 to 80	5 to 10	>10	0.04 to 0.07	6.1 to 6.5	High	Low.
SM	A-1	70 to 80	50 to 80	10 to 20	>10	0.05 to 0.07	6.6 to 7.3	High	Low.
GM-GP	A-1	40 to 60	30 to 50	0 to 10	>10	0.02 to 0.04	6.6 to 7.3	High	Low.
ML-SM	A-4	65 to 90	50 to 80	40 to 60	0.8 to 2.5	0.12 to 0.14	5.6 to 7.3	Moderate	Low.
GM	A-2	30 to 60	20 to 50	10 to 20	5.0 to 10.0	0.08 to 0.10	5.6 to 6.0	High	Low.
ML to CL	A-4	90 to 100	80 to 95	55 to 80	0.8 to 2.5	0.17 to 0.20	6.6 to 7.3	Moderate	Low to moderate.

TABLE 6.—*Brief descriptions of soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification: USDA texture
			In.	
VaC	Vassar silt loam, 0 to 30 percent slopes.	Deep, medium-textured, well-drained soils formed from volcanic ash, silt, and gneiss residuum in mountainous areas above an elevation of 3,000 feet; gneiss bedrock below depth of 55 inches.	0 to 22	Silt loam
VaD	Vassar silt loam, 30 to 55 percent slopes.		22 to 55	Gravelly loam
VsD	Vassar very rocky silt loam, 20 to 55 percent slopes.	Vassar part similar to Vassar silt loam soils. Rock outcrop (gneiss) included with this mapping unit.		
We	Wethey loamy sand.	Very deep, moderately coarse textured, poorly drained alluvial soils; occur in seeps and along streams in sandy areas; depth to seasonal high water table ranges from 3 to 5 feet.	0 to 23	Loamy sand and sand.
			23 to 45	Fine sandy loam or loamy fine sand.
			45 to 60	Loam or silt loam; lenses and pockets of sand are common.
Wh	Wethey loamy sand, drained.	Similar to Wethey loamy sand, except that it is somewhat poorly drained; depth to seasonal high water table ranges from 4 to 6 feet.		
Wo	Wolfeson very fine sandy loam.	Very deep, somewhat poorly drained soil developed from glaciofluvial material that overlies silty, noncalcareous lake sediments.	0 to 35	Very fine sandy loam to fine sandy loam.
			35 to 60	Clay loam to silty clay loam stratified with loamy fine sand.

TABLE 7.—*Interpretation of*

[Fresh water marsh (Fm), Riverwash (Rh), and Rock outcrop (Ro)

Soil series or type, and map symbols	Suitability as source of—: Topsoil	Suitability as source of—: Sand [1]	Suitability as source of—: Gravel [1]	Suitability as source of—: Road fill	Soil features affecting—: Highway location	Soil features affecting—: Dikes or levees	Soil features affecting—: Farm ponds: Reservoir area
Athena (AaA, AaC, AaD, AaE, part of AlC and AlD).	Good	Not suitable.	Not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Bernhill silt loam (BaB, BaC, BaD, part of BkC and BkD).	Good	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.

See footnote at end of table.

estimated physical and chemical properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction (1:5 dilution)	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
					In. per hr.	*In. per in. of soil*	*pH*		
ML–CL	A–4	95 to 100	90 to 95	60 to 80	0. 8 to 2. 5	0. 17 to 0. 20	6. 1 to 6. 5	Moderate	Low to moderate.
SM	A–4	80 to 90	50 to 80	35 to 50	2. 5 to 5. 0	0. 12 to 0. 14	5. 6 to 6. 0	High	Low.
SP	A–3	90 to 100	90 to 100	0 to 10	>10	0. 07 to 0. 9	6. 6 to 7. 3	High	Low.
SM	A–2	90 to 100	90 to 100	20 to 30	2. 5 to 5. 0	0. 12 to 0. 14	6. 6 to 7. 3	High	Low.
ML–CL	A–4	90 to 100	90 to 95	60 to 85	0. 8 to 2. 5	0. 17 to 0. 20	6. 6 to 7. 3	Moderate	Low to moderate.
SM	A–2	95 to 100	90 to 100	25 to 35	0. 8 to 2. 5	0. 12 to 0. 14	6. 1 to 7. 3	High	Low.
CL	A–6	95 to 100	90 to 100	85 to 95	0. 5 to 0. 2	0. 17 to 0. 20	6. 6 to 7. 3	Low	Moderate.

engineering properties of soils

not included in table, because they are too variable to permit valid interpretation]

Soil features affecting—Continued						
Farm ponds—Continued	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Embankment						
Very low shear strength; semi-pervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; very high water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate permeability; very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.
Very low shear strength; semi-pervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; very high water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate permeability; very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of—				Soil features affecting—		
	Topsoil	Sand [1]	Gravel [1]	Road fill	Highway location	Dikes or levees	Farm ponds: Reservoir area
Bernhill silt loam, moderately shallow (BbB, BbD, part of BhD).	Good	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Bernhill gravelly silt loam (BeB, part of BhD).	Good	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate permeability; low shrink-swell potential.	Low stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate permeability.
Bernhill very stony silt loam (BfB, BfD)	Fair to poor.	Not suitable.	Not suitable.	Fair to good.	Moderate to high susceptibility to frost action; moderate permeability; low shrink-swell potential.	Moderate to low stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate permeability.
Bong (BoB, part of BpB, BrB, BrC, and BsB).	Fair	Not suitable in surface layers.	Not suitable.	Good	Slight to moderate susceptibility to frost action; moderately rapid to very rapid permeability; low shrink-swell potential.	Low stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderately rapid to very rapid permeability.
Bonner (BtB, BuB, BvB, BwB).	Good to poor.	Upper layers not suitable.	Upper layers not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate to very rapid permeability; low shrink-swell potential.	Semipervious when compacted; very slight compressibility; high stability.	Moderate to very rapid permeability.
Brickel stony loam (BxD).	Good to poor.	Not suitable.	Not suitable.	Fair to good.	Slight to high susceptibility to frost action; moderate to rapid permeability; low shrink-swell potential.	Low stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate to rapid permeability.
Bridgeson silt loam (By, Bz).	Good to fair.	Not suitable.	Not suitable	Poor	Moderate to very high susceptibility to frost action; moderate to slow permeability; low to moderate shrink-swell potential; soils subject to seasonal flooding and high water table.	Moderate stability; impervious when compacted; low to moderate shrink-swell potential; soils crack when dry.	Moderate to slow permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Very low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; moderate to low water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; moderate to low water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate permeability; moderate to low water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.
Very low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; moderate to low water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; moderate to low water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate permeability; moderate to low water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.
Low shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate permeability.	Moderate intake rate; moderate water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; moderate water-holding capacity; vegetation difficult to establish.	Moderate permeability; moderate water-holding capacity.	Low shear strength; high load-carrying capacity; moderate permeability.
Low shear strength; semipervious to impervious when compacted; very slight compressibility; low stability.	Moderately rapid to very rapid permeability.	Rapid intake rate; low to moderate water-holding capacity.	Low resistance to erosion; moderately rapid to very rapid permeability.	Low resistance to erosion; low to moderate water-holding capacity; vegetation easy to establish.	Moderately rapid to very rapid permeability; low to moderate water-holding capacity.	Low shear strength; high load-carrying capacity; moderately rapid to very rapid permeability.
Moderate shear strength; semipervious when compacted; very slight compressibility; high stability.	Moderate to very rapid permeability.	Rapid intake rate; moderate to low water-holding capacity.	Moderate resistance to erosion; moderate to very rapid permeability.	Moderate resistance to erosion; moderate to low water-holding capacity; vegetation easy to establish.	Moderate to very rapid permeability; moderate to low water-holding capacity.	Moderate shear strength; high load-carrying capacity; moderate to very rapid permeability.
Low shear strength; semipervious to impervious when compacted; slight compressibility; low stability.	Moderate to rapid permeability.	Moderate to rapid intake rate; low water-holding capacity.	Low resistance to erosion; moderate to rapid permeability.	Low resistance to erosion; low water-holding capacity; vegetation difficult to establish.	Moderate to rapid permeability; low water-holding capacity.	Low shear strength; moderate load-carrying capacity; moderate to rapid permeability.
Very low shear strength; impervious when compacted; medium compressibility; moderate stability; soils crack when dry.	Moderate to slow permeability; soils subject to seasonal flooding and high water table; drainage outlets difficult to establish.	Moderate to slow intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderate to slow permeability.	Moderate resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish.	Moderate to slow permeability; very high water-holding capacity; soils subject to seasonal flooding and high water table.	Very low shear strength; moderate load-carrying capacity; moderate to slow permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of— Topsoil	Sand [1]	Gravel [1]	Road fill	Soil features affecting— Highway location	Dikes or levees	Farm ponds: Reservoir area
Caldwell silt loam (Ca).	Good to poor.	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential; often flooded for short periods in spring.	Moderate stability; impervious when compacted; low to moderate shrink-swell potential; cracks when dry.	Moderate to moderately slow permeability.
Cedonia (CeA, CeB, CeC3).	Good to poor.	Not suitable.	Not suitable.	Fair	Moderate to very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately slow permeability.
Cheney (CgB, ChB, part of CkC, CmC, CnB, and CoB).	Good	Not suitable.	Good in subsoil layers.	Fair to very good.	Moderate to high susceptibility to frost action in upper layers, slight at greater depths; moderate to very rapid permeability; low shrink-swell potential.	Moderate stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate to very rapid permeability.
Clayton (CsA, CsB, CtA, CtB, CuB).	Fair	Fair to good below depth of 60 inches.	Not suitable.	Good	Slight susceptibility to frost action; moderate to moderately rapid permeability; low shrink-swell potential.	Moderate stability; pervious when compacted; low shrink-swell potential.	Moderate to moderately rapid permeability.
Cocolalla (Cw, Cy).	Fair to good.	Not suitable.	Not suitable.	Very poor.	Very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential; saturated 2 to 7 months of the year.	Low stability; semipervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately slow permeability.
Dearyton (DaA, DaB, DaC, DeB).	Good	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate to slow permeability; low to high shrink-swell potential; saturated late in winter and early in spring.	Low stability; impervious when compacted; low to high shrink-swell potential.	Moderate to slow permeability.

See footnote at end of table.

properties of soils –Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Very low shear strength; impervious when compacted; medium compressibility; moderate stability; cracks when dry.	Moderate to moderately slow permeability; subject to flooding and silt deposition; drainage outlets difficult to establish.	Moderate to slow intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderate to moderately slow permeability.	Moderate resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish.	Moderate to moderately slow permeability; very high water-holding capacity; subject to flooding in spring.	Very low shear strength; moderate load-carrying capacity; moderate to moderately slow permeability.
Very low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate to moderately slow permeability.	Moderately slow to slow intake rate; high to very high water-holding capacity.	Moderate resistance to erosion; moderate to moderately slow permeability.	Moderate resistance to erosion; high to very high water-holding capacity; vegetation easy to establish.	Moderate to moderately slow permeability; high to very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate to moderately slow permeability.
Moderate to high shear strength; semipervious to impervious when compacted; slight compressibility; moderate to high stability.	Moderate to very rapid permeability.	Moderate intake rate; moderate to low water-holding capacity.	Moderate to high resistance to erosion; moderate to very rapid permeability.	Moderate to high resistance to erosion; moderate to low water-holding capacity; vegetation difficult to establish.	Moderate to very rapid permeability; moderate to low water-holding capacity.	Moderate to high shear strength; moderate to high load-carrying capacity; moderate to very rapid permeability.
Very high shear strength; pervious when compacted; very slight compressibility; moderate stability.	Moderate to moderately rapid permeability.	Moderate intake rate; moderate water-holding capacity.	Moderate to low resistance to erosion; moderate to moderately rapid permeability.	Moderate to low resistance to erosion; moderate water-holding capacity; vegetation fairly easy to establish.	Moderate to moderately rapid permeability; moderate water-holding capacity.	High shear strength; moderate load-carrying capacity; moderate to moderately rapid permeability.
Very low shear strength; semipervious when compacted; medium to high compressibility; low stability.	Moderate to moderately slow permeability; saturated 2 to 7 months of the year.	Moderate intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderate to moderately slow permeability.	Moderate resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish.	Moderate to moderately slow permeability; very high water-holding capacity; saturated 2 to 7 months of the year.	Very low shear strength; very low load-carrying capacity; moderate to moderately slow permeability.
Very low shear strength; impervious when compacted; medium to high compressibility; moderate stability.	Moderate to slow permeability; soils saturated late in winter and early in spring.	Moderate to slow intake rate; high to very high water-holding capacity.	Moderate resistance to erosion; moderate to slow permeability.	Moderate resistance to erosion; high to very high water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate to slow permeability; high to very high water-holding capacity; saturated late in winter and early in spring.	Very low shear strength; moderate load-carrying capacity; moderate to slow permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of—				Soil features affecting—		
	Topsoil	Sand [1]	Gravel [1]	Road fill	Highway location	Dikes or levees	Farm ponds: Reservoir area
Dragoon (DrC, DsC, DsD, DvD).	Good to poor.	Not suitable.	Not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate to moderately rapid permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately rapid permeability.
Eloika (EkB, ElC, ElD).	Fair	Not suitable.	Suitable at depth greater than 60 inches.	Good	Moderate to high susceptibility to frost action; moderate to very rapid permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to very rapid permeability.
Emdent silt loam (Em).	Fair	Not suitable.	Not suitable.	Poor	Very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential; saturated in winter and spring.	Low stability; impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately slow permeability.
Freeman (FaB, FaB3, FaC3).	Fair to poor.	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderately slow to very slow permeability; low to moderate shrink-swell potential; saturated in spring.	Moderate stability; impervious when compacted; low to moderate shrink-swell potential; soils crack when dry.	Moderately slow to very slow permeability.
Garfield (GaC3)	Fair to good.	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to slow permeability; moderate to high shrink-swell potential.	Moderate stability; impervious when compacted; moderate to high shrink-swell potential.	Moderate to slow permeability.
Garrison (GgA, GgB, GmB, GnB).	Fair	Not suitable.	Good below surface layer.	Excellent	Slight to no susceptibility to frost action; moderate to very rapid permeability; low shrink-swell potential.	Moderate stability; pervious when compacted; low shrink-swell potential.	Moderate to very rapid permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Very low shear strength; semi-pervious to impervious when compacted; medium compressibility; low stability.	Moderate to moderately rapid permeability.	Moderate intake rate; moderate water-holding capacity.	Low resistance to erosion; moderate to moderately rapid permeability.	Low resistance to erosion; moderate water-holding capacity; vegetation difficult to establish except on Dragoon silt loam.	Moderate to moderately rapid permeability; moderate to moderately rapid water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate to moderately rapid permeability.
Low shear strength; semipervious to impervious when compacted; slight compressibility; low stability.	Moderate to very rapid permeability.	Moderate to moderately rapid intake rate; moderate water-holding capacity.	Moderate resistance to erosion; moderate to very rapid permeability.	Moderate resistance to erosion; moderate water-holding capacity; vegetation difficult to establish except on Eloika silt loam.	Moderate to very rapid permeability; moderate water-holding capacity.	Low shear strength; moderate to high load-carrying capacity; moderate to very rapid permeability.
Very low shear strength; impervious when compacted; moderate to high compressibility; moderate stability; cracks when dry.	Moderate to moderately slow permeability; saturated in winter and spring.	Moderate to moderately slow intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderate to moderately slow permeability.	Moderate resistance to erosion; very high water-holding capacity; except for salt-tolerant species, vegetation difficult to establish.	Moderate to moderately slow permeability; very high water-holding capacity; saturated in winter and spring.	Very low shear strength; moderate to low load-carrying capacity; moderate to moderately slow permeability.
Very low shear strength; impervious when compacted; medium compressibility; moderate stability; soils crack when dry.	Moderately slow to very slow permeability; saturated in spring.	Moderately slow to slow intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderately slow to very slow permeability.	Moderate resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish.	Moderately slow to very slow permeability; very high water-holding capacity; saturated in spring.	Very low shear strength; moderate load-carrying capacity; moderately slow to very slow permeability.
Very low shear strength; impervious when compacted; medium to high compressibility; moderate stability; soil cracks when dry.	Moderate to slow permeability.	Slow intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderate to slow permeability.	Moderate resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish.	Moderate to slow permeability; very high water-holding capacity.	Very low shear strength; moderate load-carrying capacity; moderate to slow permeability.
High shear strength; pervious when compacted; slight compressibility; moderate stability.	Moderate to very rapid permeability.	Rapid intake rate; moderate to low water-holding capacity.	Moderate resistance to erosion; moderate to very rapid permeability.	Moderate resistance to erosion; moderate to low water-holding capacity; vegetation difficult to establish on very stony loam, fairly easy on other soils.	Moderate to very rapid permeability; moderate to low water-holding capacity.	High shear strength; high load-carrying capacity; moderate to very rapid permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of— Topsoil	Sand	Gravel [1]	Road fill	Soil features affecting— Highway location	Dikes or levees	Farm ponds: Reservoir area
Glenrose (GpA, GpB, GpC, GpD, GrB, GrD, GsD).	Good to fair.	Not suitable.	Not suitable.	Fair to good.	Moderate to high susceptibility to frost action; moderate permeability; low to moderate shrink-swell-potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Green Bluff (GtA, GtB).	Good	Not suitable.	Not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Hagen (HfC, HgB).	Fair to poor.	Fair in subsoil layers.	Not suitable.	Good	Low to no susceptibility to frost action; moderately rapid to very rapid permeability; low shrink-swell potential.	Moderate stability; pervious when compacted; low shrink-swell potential.	Moderately rapid to very rapid permeability.
Hardesty (HhA, HmA).	Fair	Unsuitable	Unsuitable	Fair to poor.	Moderate to very high susceptibility to frost action; moderrate to rapid permeability; low shrink-swell potential.	Low stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate to rapid permeability.
Hesseltine (HnB, HoB, HrB, HsB, HtB, HvC, HvD, HxC).	Good	Not suitable.	Good in subsoil layers.	Fair to good.	Moderate to low susceptibility to frost action; moderate to very rapid permeability; low to moderate shrink-swell potential.	Moderate stability; semipervious to pervious when compacted; low to moderate shrink-swell potential.	Moderate to very rapid permeability.
Konner (Kc, Kd)	Good to fair.	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderately slow to slow permeability; moderate shrink-swell potential; saturated during winter and spring, often flooded and fresh material deposited on the surface.	Moderate stability; impervious when compacted; moderate shrink-swell potential; cracks when dry.	Moderately slow to slow permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; very high to high water-holding capacity.	Moderate to low resistance to erosion; moderate permeability.	Moderate to low resistance to erosion; very high to high water-holding capacity; vegetation difficult to establish on stony silt loam, fairly easy on other soils where waterways are likely to be needed.	Moderate permeability; high to very high water-holding capacity.	Low shear strength; low load-carrying capacity; moderate permeability.
Low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; very high water-holding capacity; vegetation easy to establish.	Moderate permeability; very high water-holding capacity.	Low shear strength; low load-carrying capacity; moderate permeability.
High shear strength; pervious when compacted; very slight compressibility; moderate stability.	Moderately rapid to very rapid permeability.	Moderately rapid intake rate; moderate water-holding capacity.	Moderate to low resistance to erosion; moderately rapid to rapid permeability.	Moderate to low resistance to erosion; moderate water-holding capacity; vegetation difficult to establish.	Moderately rapid to very rapid permeability; moderate water-holding capacity.	Low shear strength; high load-carrying capacity; moderately rapid to very rapid permeability.
Very low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate to rapid permeability.	Moderate intake rate; moderate to very high water-holding capacity.	Moderate resistance to erosion; moderate to rapid permeability.	Moderate resistance to erosion; moderate to very high water-holding capacity; vegetation fairly easy to establish.	Moderate to rapid permeability; moderate to very high water-holding capacity.	Very low shear strength; moderate load-carrying strength; moderate to rapid permeability.
Moderate to high shear strength; semipervious when compacted; medium to slight compressibility; moderate stability.	Moderate to very rapid permeability.	Moderately rapid intake rate; moderate to low water-holding capacity.	Moderate resistance to erosion; moderate to very rapid permeability.	Moderate resistance to erosion; moderate to low water-holding capacity; vegetation fairly difficult to establish, except on stony or rocky areas, where it is difficult.	Moderate to very rapid permeability; moderate to low water-holding capacity.	Moderate to high shear strength; high load-carrying capacity; moderate to very rapid permeability.
Very low shear strength; impervious when compacted; medium compressibility; medium stability; cracks when dry.	Moderately slow to slow permeability; saturated during winter and spring.	Slow intake rate; high water-holding capacity.	Low resistance to erosion; moderately slow to slow permeability.	Low resistance to erosion; high water-holding capacity; vegetation fairly difficult to establish.	Moderately slow to slow permeability; high water-holding capacity; saturated during winter and spring.	Very high shear strength; moderate to low load-carrying capacity; moderately slow to slow permeability.

221-715—68——7

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of— Topsoil	Sand [1]	Gravel [1]	Road fill	Soil features affecting— Highway location	Dikes or levees	Farm ponds: Reservoir area
Lakesol (LaB, LaD).	Good to poor.	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential.	Moderate stability; impervious when compacted; low to moderate shrink-swell potential; cracks when dry.	Moderate to moderately slow permeability.
Laketon (LeA, LeB, LfA).	Good	Not suitable.	Not suitable.	Fair	Moderate to very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential; saturated in winter and spring; seeps common in spring in places.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately slow permeability.
Lance (LmC, LmC3, part of AlC and AlD).	Fair to poor.	Not suitable.	Not suitable.	Fair	Moderate to high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately slow permeability.
Larkin (LnA2, LnB2, LnD2).	Good	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Latah (Lt)	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to very slow permeability; moderate to high shrink-swell potential; saturated during winter and spring; water table near the surface late in spring; low areas subject to flooding.	Moderate stability; impervious when compacted; moderate to high shrink-swell potential.	Moderate to very slow permeability.
Marble (MaC, MbC, McB).	Fair	Good in subsoil layers.	Not suitable.	Good	Slight to no susceptibility to frost action; moderately rapid to very rapid permeability; low shrink-swell potential.	Moderate stability; pervious when compacted; low shrink-swell potential.	Moderately rapid to rapid permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Very low shear strength; impervious when compacted; medium compressibility; medium stability; cracks when dry.	Moderate to moderately slow permeability.	Slow intake rate; high water-holding capacity.	Moderate to low resistance to erosion; moderate to moderately slow permeability.	Moderate to low resistance to erosion; high water-holding capacity; vegetation fairly easy to establish where waterways are likely to be needed.	Moderate to moderately slow permeability; high water-holding capacity.	Very low shear strength; moderate to low load-carrying capacity; moderate to moderately slow permeability.
Very low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate to moderately slow permeability; saturated in winter and spring.	Slow intake rate; high water-holding capacity.	Low resistance to erosion; moderate to moderately slow permeability.	Low resistance to erosion; high water-holding capacity; vegetation easy to establish.	Moderate to moderately slow permeability; high water-holding capacity; saturated in winter and spring.	Low shear strength; low load-carrying capacity; moderate to moderately slow permeability.
Low shear strength; semipervious to impervious when compacted.	Moderate to moderately slow permeability.	Moderate intake rate; moderate water-holding capacity.	Moderate to low resistance to erosion; moderate to moderately slow permeability.	Moderate to low resistance to erosion; moderate water-holding capacity; vegetation fairly difficult to establish.	Moderate to moderately slow permeability; moderate water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate to moderately slow permeability.
Low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish where waterways are likely to be needed.	Moderate permeability; very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.
Very low shear strength; impervious when compacted; medium compressibility; low stability.	Moderate to very slow permeability; subject to seasonal flooding; saturated during winter and spring; water table near the surface late in spring.	Slow intake rate; very high water-holding capacity.	Moderate to low resistance to erosion; moderate to very slow permeability.	Moderate to low resistance to erosion; very high water-holding capacity; vegetation fairly easy to establish.	Moderate to very slow permeability; very high water-holding capacity; saturated during winter and spring; water near the surface late in spring.	Very low shear strength; low load-carrying capacity; moderate to very slow permeability.
High shear strength; pervious when compacted; slight compressibility; moderate stability.	Moderately rapid to very rapid permeability.	Rapid intake rate; low water-holding capacity.	Low resistance to erosion; moderately rapid to very rapid permeability.	Low resistance to erosion; low water-holding capacity; vegetation difficult to establish.	Moderately rapid to very rapid permeability; low water-holding capacity.	High shear strength; high load-carrying capacity; moderately rapid to very rapid permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of— Topsoil	Sand [1]	Gravel [1]	Road fill	Soil features affecting— Highway location	Dikes or levees	Farm ponds: Reservoir area
Mondovi (Md)	Good	Not suitable.	Not suitable.	Fair to poor.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Moscow (MmC, MmD, MoC, MoD, part of MsC and MsE).	Fair	Not suitable.	Not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate to moderately rapid permeability; low to moderate shrink-swell potential.	Moderate stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately rapid permeability.
Naff (NaA, NaC, NaA2, NaC2, NaD2, NaC3).	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to moderately slow permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately slow permeability.
Narcisse (NcA)	Good	Not suitable.	Not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate to moderately rapid permeability; low to moderate shrink-swell potential; flooded in places, and fresh material is deposited on surface.	Low stability; semipervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately rapid permeability.
Nez Perce (NpA, NpB NpB3).	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to slow permeability; low to high shrink-swell potential; saturated for a few weeks in spring; in nearly level areas, water ponds on the surface.	Low stability; impervious when compacted; low to high shrink-swell potential.	Moderate to slow permeability.
Palouse (PaB, PaC, PoC2, part of PcC and PcE)	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate permeability; moderate shrink-swell potential.	Low to moderate stability; semipervious to impervious when compacted; moderate shrink-swell potential.	Moderate permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued						
Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Very low shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate permeability.	Moderate intake rate; very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; very high water-holding capacity; vegetation easy to establish.	Moderate permeability; very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.
Moderate to low shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate to moderately rapid permeability.	Moderate intake rate; moderate to low water-holding capacity.	Moderate to high resistance to erosion; moderate to moderately rapid permeability.	Moderate to high resistance to erosion; moderate to low water-holding capacity; vegetation fairly easy to establish on Moscow silt loam, difficult on others.	Moderate to moderately rapid permeability; moderate to low water-holding capacity.	Moderate to low shear strength; moderate load-carrying capacity; moderate to moderately rapid permeability.
Moderate shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate to moderately slow permeability.	Moderate intake rate; very high to moderate water-holding capacity.	Low resistance to erosion; moderate to moderately slow permeability.	Low resistance to erosion; very high to moderate water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate to moderately slow permeability; very high to moderate water-holding capacity.	Low shear strength; low load-carrying capacity; moderate to moderately slow permeability.
Low shear strength; semipervious when compacted; slight compressibility; low stability.	Moderate to moderately rapid permeability.	Moderate intake rate; high water-holding capacity.	Moderate to low resistance to erosion; moderate to moderately rapid permeability.	Moderate to low resistance to erosion; high water-holding capacity; vegetation easy to establish.	Moderate to moderately rapid permeability; high water-holding capacity.	Moderate to high shear strength; moderate to high load-carrying capacity; moderately rapid permeability.
Very low shear strength; impervious when compacted; medium compressibility; moderate stability.	Moderate to slow permeability; soils saturated for a few weeks in spring; in nearly level areas, water ponds on the surface.	Moderate to slow intake rate; very high water-holding capacity.	Moderate to low resistance to erosion; moderate to slow permeability.	Moderate to low resistance to erosion; very high water-holding capacity; vegetation easy to establish.	Moderate to slow permeability; very high water-holding capacity; saturated for a few weeks in spring; in nearly level areas, water ponds on the surface.	Very low shear strength; low load-carrying capacity; moderate to slow permeability.
Very low shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate permeability.	Moderate intake rate; moderate to very high water-holding capacity.	Moderate resistance to erosion; moderate permeability.	Moderate resistance to erosion; moderate to very high water-holding capacity; vegetation easy to establish except in rocky areas.	Moderate permeability; moderate to very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of— Topsoil	Sand [1]	Gravel [1]	Road fill	Soil features affecting— Highway location	Dikes or levees	Farm ponds: Reservoir area
Peone (PeA, PoA)	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to very rapid permeability; low to moderate shrink-swell potential; saturated in spring, and in places water stands on the surface; many areas subject to flooding and deposition.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to very rapid permeability.
Phoebe (PsA, PsB, part of BpB, BrB, BrC, and BsB).	Good	Not suitable in upper layers; good at depth greater than 48 inches.	Not suitable.	Good	Moderate susceptibility to frost action; moderately rapid to very rapid permeability; low shrink-swell potential.	Moderate to low stability; semipervious to pervious when compacted; low shrink-swell potential.	Moderately rapid to very rapid permeability.
Reardan (RdA, RdB, RdB2, RdC2).	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate to slow permeability; low to high shrink-swell potential; saturated in spring.	Low stability; impervious when compacted; low to high shrink-swell potential.	Moderate to slow permeability.
Schumacher (SaB, SaC, SaD, SaB2, SaC2, ScC, ScD, ScC2, ScD2).	Good	Not suitable.	Not suitable.	Fair to good.	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Moderate stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Semiahmoo (Se, Sk, Sm).	Good (used for mulch).	Not suitable.	Not suitable.	Very poor.	Very high susceptibility to frost action; moderate permeability; undrained areas saturated much of year.	Very low stability; pervious when compacted.	Moderate permeability.
Snow (SnA, SnC)	Good	Not suitable.	Not suitable.	Poor	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate to very rapid permeability; saturated in spring, and in places water stands on the surface; many areas subject to flooding and deposition.	Moderate intake rate; very high water-holding capacity.	Moderate resistance to erosion; moderate to very rapid permeability.	Moderate resistance to erosion; very high water-holding capacity; vegetation easy to establish.	Moderate to very rapid permeability; very high water-holding capacity; saturated in spring and in places water stands on the surface; many areas subject to flooding and deposition.	Low shear strength; low load-carrying capacity; moderate to very rapid permeability.
Low shear strength; semipervious to pervious when compacted; slight compressibility; moderate stability.	Moderately rapid to very rapid permeability.	Rapid intake rate; moderate water-holding capacity.	Low resistance to erosion; moderately rapid to very rapid permeability.	Low resistance to erosion; moderate water-holding capacity; vegetation easy to establish.	Moderately rapid to very rapid permeability; moderate water-holding capacity.	Low shear strength; high load-carrying capacity; moderately rapid to very rapid permeability.
Very low shear strength; moderate to slow permeability when compacted; moderate stability; cracks when dry.	Moderate to slow permeability; saturated in spring.	Slow intake rate; high to very high water-holding capacity.	Moderate resistance to erosion; moderate to slow permeability.	Moderate resistance to erosion; high to very high water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate to slow permeability; high to very high water-holding capacity; saturated in spring.	Very low shear strength; moderate load-carrying capacity; moderate to slow permeability.
Low shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate permeability.	Moderate intake rate; high to very high water-holding capacity.	Moderate resistance to erosion; moderate permeability.	Moderate resistance to erosion; high to very high water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate permeability; high to very high water-holding capacity.	Low shear strength; moderate load-carrying capacity; moderate permeability.
Very low shear strength; pervious when compacted; very high compressibility.	Moderate permeability; undrained areas are saturated much of year.	Moderate intake rate; moderate to very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; moderate to very high water-holding capacity; vegetation easy to establish.	Moderate permeability; moderate to very high water-holding capacity; undrained areas saturated much of the year.	Very low shear strength; very low load-carrying capacity; moderate permeability.
Very low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate intake rate; very high water-holding capacity.	Low resistance to erosion; moderate permeability.	Low resistance to erosion; very high water-holding capacity; vegetation easy to establish.	Moderate permeability; very high water-holding capacity.	Very low shear strength; low load-carrying capacity; moderate permeability.

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of— Topsoil	Sand [1]	Gravel [1]	Road fill	Soil features affecting— Highway location	Dikes or levees	Farm ponds: Reservoir area
Speigle (SoE)	Fair	Not suitable.	Not suitable.	Fair	Slight to high susceptibility to frost action; moderate permeability; low shrink-swell potential.	Moderate stability; impervious when compacted; low shrink-swell potential.	Moderate permeability.
Spokane (SpC, SpD, SrC, SrE, part of SsC, SsE, StC, StE, and SuE).	Good	Not suitable.	Not suitable.	Good	Slight susceptibility to frost action; moderate to rapid permeability; low shrink-swell potential.	Low stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate to rapid permeability.
Springdale (SwB, SxB, SyB, SzE).	Fair	Fair	Good	Very good	Slight susceptibility to frost action; rapid to very rapid permeability; low shrink-swell potential.	Moderate to high stability; semipervious to pervious when compacted; low shrink-swell potential.	Rapid to very rapid permeability.
Tekoa (TeB, TeC, TeD, part of TkD).	Fair	Not suitable.	Not suitable.	Fair	Moderate to high susceptibiliy to frost action; moderate to rapid permeability; low shrink-swell potential.	Moderate stability; semipervious to impervious when compacted; low shrink-swell potential.	Moderate to rapid permeability.
Uhlig (UhA, UhB, UmC, part of CnB and CoB).	Good	Not suitable.	Not suitable.	Fair	Moderate to very high susceptibility to frost action; moderate permeability; low to moderate shrink-swell potential.	Moderate stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate permeability.
Vassar silt loam (VaC, VaD, part of VsD).	Fair to poor.	Not suitable.	Not suitable.	Fair	Moderate to very high susceptibility to frost action; moderate to moderately rapid permeability; low to moderate shrink-swell potential.	Moderate stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to moderately rapid permeability.

See footnote at end of table.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
Low shear strength; impervious when compacted; slight compressibility; moderate stability.	Moderate permeability.	Moderate intake rate; high water-holding capacity.	Moderate resistance to erosion; moderate permeability.	Moderate resistance to erosion; high water-holding capacity; vegetation difficult to establish.	Moderate permeability; high water-holding capacity.	Low shear strength; moderate load-carrying capacity; moderate permeability.
Low shear strength; semipervious to impervious when compacted.	Moderate to rapid permeability.	Moderate to rapid intake rate; moderate to low water-holding capacity.	Moderate resistance to erosion; moderate to rapid permeability.	Moderate resistance to erosion; moderate to low water-holding capacity; vegetation difficult to establish except on areas of Spokane loam, where it is fairly easy to establish and where waterways are likely to be needed.	Moderate to rapid permeability; moderate to low water-holding capacity.	Low shear strength; high load-carrying capacity; moderate to rapid permeability.
High shear strength; semipervious to pervious when compacted; slight compressibility; moderate to high stability.	Rapid to very rapid permeability.	Rapid intake rate; moderate to low water-holding capacity.	Moderate to low resistance to erosion; rapid to very rapid permeability.	Moderate to low resistance to erosion; moderate to low water-holding capacity; vegetation fairly difficult to difficult to establish, depending on cobblestone content.	Rapid to very rapid permeability; moderate to low water-holding capacity.	High shear strength; high load-carrying capacity; rapid to very rapid permeability.
Low shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate to rapid permeability.	Moderate to slow intake rate; moderate water-holding capacity.	Moderate to low resistance to erosion; moderate to rapid permeability.	Moderate to low resistance to erosion; moderate water-holding capacity; vegetation fairly easy to establish where waterways are likely to be needed.	Moderate to rapid permeability; moderate water-holding capacity.	Low shear strength; moderate load-carrying capacity; moderate to rapid permeability.
Low shear strength; semipervious to impervious when compacted; medium compressibility; low stability.	Moderate permeability.	Moderate to slow intake rate; high to very high water-holding capacity.	Moderate to low resistance to erosion; moderate permeability.	Moderate to low resistance to erosion; high to very high water-holding capacity; vegetation easy to establish.	Moderate permeablity; high to very high water-holding capacity.	Very low shear strength; moderate to low load-carrying capacity; moderate permeability.
Moderate shear strength; semipervious to impervious when compacted, medium compressibility; low stability.	Moderate to moderately rapid permeability.	Moderate intake rate; moderate water-holding capacity.	Moderate resistance to erosion; moderate to moderately rapid permeability.	Moderate resistance to erosion; moderate water-holding capacity; vegetation easy to establish where waterways are likely to be needed.	Moderate to moderately rapid permeability; moderate water-holding capacity.	Moderate shear strength; moderate load-carrying capacity; moderate to moderately rapid permeability.

221-715—68——8

TABLE 7.—*Interpretation of engineering*

Soil series or type, and map symbols	Suitability as source of—				Soil features affecting—		
	Topsoil	Sand [1]	Gravel [1]	Road fill	Highway location	Dikes or levees	Farm ponds: Reservoir area
Wethey (We, Wh)	Fair	Not suitable.	Not suitable.	Good	Slight susceptibility to frost action; moderate to very rapid permeability; low shrink-swell potential; subject to seasonal flooding and high water table.	Moderate stability; pervious when compacted; low shrink-swell potential.	Moderate to very rapid permeability.
Wolfeson (Wo)	Poor to fair.	Not suitable.	Not suitable.	Good	Slight to high susceptibility to frost action; moderate to slow permeability; low to moderate shrink-swell potential; saturated in winter and spring; seasonally ponded in places.	Low stability; semipervious to impervious when compacted; low to moderate shrink-swell potential.	Moderate to slow permeability.

[1] If soil is rated as being suitable for sand and gravel, washing will probably be needed for clean sand and gravel.

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system soil materials are classified in seven principal groups. The groups range from A–1, which consists of gravelly soils that have high bearing capacity and are the best soils for subgrades, to A–7, which consists of clay soils that have low strength when wet and are the poorest for subgrades.

Some engineers prefer to use the Unified Soil Classification System (*12*). In this system soil materials are identified as coarse grained (8 classes), fine grained (6 classes), and highly organic.

Permeability, as shown in table 6, is the rate at which water moves through soil material that has not been disturbed. It depends largely upon the soil texture and structure.

The available water capacity is approximately the amount of capillary water in soil that is wet to field capacity. This amount of water will wet air-dry soil material to a depth of 1 inch without deeper percolation.

In table 6 reaction is shown in pH values, which indicate the estimated acidity or alkalinity of the soil. A pH value of less than 7.0 indicates acidity, and one of more than 7.0 indicates alkalinity.

The ratings for dispersion indicate the extent to which soil structure breaks down or slakes in water. An easily dispersed soil seals over and resists penetration by water and air. It is readily eroded by wind or water.

The ratings for shrink-swell potential indicate the change in volume that results from change in moisture content; that is, the shrinking of the soil when it dries and the swelling of the soil as it takes up moisture. In general, soils classed as CL, CH, A–6 or A–7 have a moderate to high shrink-swell potential. Soils with a high shrink-swell potential have severe limitations for use as sites for concrete structures.

Interpretations.—In table 7 suitability of the soils for topsoil, sand, gravel, and road fill are given, as well as features affecting use of the soils for highways, dikes or levees, farm ponds, irrigation systems, terraces and diversions, waterways, and sewage disposal fields. Also given are soil features affecting agricultural drainage and trafficability.

The interpretations in this table are based on the information in table 6, on test data obtained by the Division of Industrial Research, Washington State University, and on field performance. They are general and will not take the place of examination and evaluation of the soil at the exact site of a planned engineering project.

The soil features noted in table 7 may affect the selection of a site, the design of a structure, or the application of practice for land treatment. Some features may be helpful in one kind of engineering work and a hindrance in another. For example, a rapidly permeable substratum would make a soil unsuitable as a site for a farm pond but highly suitable for use as a septic tank field.

Frost action is an important item in soil engineering. Frozen soils should not be used in constructing embankments. Earthwork may be performed in winter, however, if the material used (1) is gravelly or sandy and does not contain more than a small percentage of silt or clay, (2) is compacted according to the required standards for such construction, and (3) does not include frozen material.

properties of soils—Continued

Soil features affecting—Continued						
Farm ponds—Continued: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Sewage disposal fields	Trafficability
High shear strength; pervious when compacted; slight compressibility; moderate stability.	Moderate to very rapid permeability; soils subject to seasonal flooding and high water table.	Rapid intake rate; moderate water-holding capacity.	Moderate to low resistance to erosion; moderate to very rapid permeability.	Moderate to low resistance to erosion; moderate water-holding capacity; vegetation fairly easy to establish.	Moderate to very rapid permeability; moderate water-holding capacity; soils subject to seasonal flooding and high water table.	High shear strength; high load-carrying capacity; moderate to very rapid permeability.
Low shear strength; semipervious to impervious when compacted; slight compressibility; low stability.	Moderate to slow permeability; subject to seasonal ponding in places.	Moderate to rapid intake rate; very high water-holding capacity.	Moderate to low resistance to erosion; moderate to slow permeability.	Moderate to low resistance to erosion; very high water-holding capacity; vegetation easy to fairly easy to establish.	Moderate to slow permeability; very high water-holding capacity; saturated in winter and spring; seasonally ponded in places.	Low shear strength; high load-carrying capacity; moderate to slow permeability.

Soil that consists of a mixture of clay, silt, and coarser materials is not so susceptible to frost heaving and subsequent frost boils as soil that contains a high percentage of silt or very fine sand. A soil is susceptible to damaging frost action if about 10 percent or more of it passes a No. 200 sieve.

Uniform soil materials are needed in subgrades to prevent frost damage. Lack of uniformity in expansion of material causes damage from frost heaving. Some deposits of glacial till contain lenses or pockets of fine sand and silt that will cause differential frost heave. Highway subgrades laid over glacial till should have a layer of suitable material that is thick enough to prevent frost heaving.

Peat is not a suitable material for use in foundations of roads or other engineering structures. Sections of peat and other highly organic material should be removed from roadways or foundations and replaced with a more suitable material to a height of 4 feet above the high water table. If possible, however, roads should be located away from areas of deep peat. A thorough field investigation is necessary before planning engineering structures in peat or highly organic soil.

Drainage ditches, constructed before earthwork is started, may make some soils that have a high water table more suitable for borrow and for roadway excavation. Underdrains may be needed where a perched or normal water table makes the soil unstable.

On bottom lands that may be flooded each year, roads should be built on a continuous embankment, so that the pavement surface is at least 3 feet above the highest level reached by the water table.

Formation and Classification of Soils

In this section the factors of soil formation are explained, the soil series are classified in higher categories, and these categories are defined. The series are then described in alphabetical order. The last part of the section contains laboratory data based on chemical and physical analyses of six selected soils.

Formation of Soils

Soil is a natural body of loose material on the earth's surface. It is formed by the forces of climate and living matter acting on parent material, as conditioned by relief, over a period of time. The properties of a soil are determined by five factors: (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the topography, or relief, of the land; (4) living organisms; and (5) the length of time the forces of soil formation have acted on the parent material.

Soils differ according to the relative degree of influence of each soil-forming factor. These factors and their influence on the soils of Spokane County are explained in the following subsections.

Parent material

The soils of Spokane County formed in materials derived mainly from loess, glacial till, glacial outwash, lake sediments, weathered acid igneous rocks, volcanic ash, stream

sediments, and organic matter. Volcanic ash and loess make up at least a minor part of the parent material of most of the soils.

Loess, which is wind-deposited silty material, is the dominant parent material of the soils in the southeastern part of the county, in the Coulee Hite area, and on the "islands" in the channeled scablands. Loess also has influenced the upper part of most soils south of the Spokane River and those on the basalt mesas north of Spokane. The loess presumably came from farther west in the Columbia Basin area, and from local glacial till and outwash. It ranges in thickness from a few inches to many feet. The thickest deposit, generally referred to as the "Palouse formation," dates from before the last glaciation. After the last glaciation, this older loess was covered with a few feet of younger and less compact loess. This thin mantle of less compact material was evidently deposited after the Palouse formation was eroded to its present topography.

During the Pleistocene epoch, large areas in the northern, central, and western parts of Spokane County were covered by glaciers. Evidence of direct ice action exists to an elevation of as much as 3,000 feet. As the ice moved southward, it mixed existing residual soils with material that was carried and ground by the ice sheets. This mixture, known as glacial till, was deposited as the ice sheets melted. It either was not reworked by water or was reworked only slightly. In general, the glacial till in the county is an unstratified, unconsolidated, heterogeneous mixture of clay, silt, sand, gravel, and, in places, boulders, derived mainly from granite, gneiss, schist, argillite, and quartzite. A thin layer of loess and volcanic ash has been deposited on top of nearly all the glacial till in the county.

As the ice melted, streams flowing from the ice front removed most of the glacial till below an elevation of 2,400 feet. Thick beds of sorted gravel and sand were deposited on terraces and plains and in stream valleys. This material, called glacial outwash, in general is sandy and gravelly and is underlain by nearly clean sand and gravel. In the northwestern part of the county, in the Spokane Valley, and in the central part of the county north of the Spokane River, the outwash is made up mostly of fragments of acid igneous rocks. In the channeled scablands in the southwestern part of the county, the outwash contains considerable basalt, which is a basic igneous rock.

Associated with the glacial outwash throughout the county are lake deposits that are silty and nongravelly This material is extensive on terrace plains in the extreme northwestern part of the county and in lateral valleys tributary to main valley troughs in the central part of the county.

Recent alluvium is the main kind of parent material along streams, in basins, and in potholes. These sediments, derived from upland areas, were deposited during periods of overflow. In most places the material is from a variety of sources and has been transported for long distances. In general, the alluvium is silty, but where streams cross soils that formed in sandy material or weathered granite, the alluvium is sandy.

Some soils in the county formed from material weathered in place from granite, gneiss, schist, sandstone, or shale. Most of the soils derived from granite are on hills or mountains in the northeastern part of the county. Sandstone and shale are the dominant parent materials of the soils on Tekoa Mountain and other promontories south of the Spokane River.

Organic matter, in various stages of decomposition, is the parent material of soils where water-loving vegetation grows and decays. Various amounts of mineral matter and diatomite are mixed with the organic matter. The largest bodies of organic soils in the county are around Newman Lake and on the Saltese Flats.

The deposits of volcanic ash vary from only thin layers at the lower elevations to layers several feet thick at elevations above 4,000 feet. Thick deposits also occur in depressions, in potholes, on flood plains, and along the toes of terrace breaks. The ash, mostly the size of silt and very fine sand, came from Glacier Peak, which erupted approximately 12,000 years ago, and from Mount Mazama, which erupted approximately 6,600 years ago (*2*).

Although all the soils have weathered to some extent, the weathering processes have not obliterated the effects of the parent material. For this reason soils that formed in similar parent material have many characteristics in common, regardless of variations in climate, topography, living organisms, and length of time the material has been weathering.

All soils that formed in loess in Spokane County contain large quantities of silt-sized particles and few if any particles larger than fine sand. In general those soils have a high base saturation and, because loess contains a variety of minerals, are above average in fertility. Athena and Naff soils are examples.

Soils that formed in glacial till contain, in addition to fairly large quantities of silt and clay, many particles coarser than fine sand. Many are extremely gravelly or cobbly. Examples are Bernhill and Eloika soils.

Bong and Phoebe are examples of soils that formed in glacial outwash and are, therefore, mostly sandy or gravelly.

Soils that formed mainly in lake sediments—for example, Cedonia and Laketon—are high in content of silt, are free of gravel and larger material, are stratified or laminated, and are high in fertility.

Soils that formed in material weathered in place from bedrock contain appreciable quantities of coarse sand, gravel, and cobblestones and are of limited depth. In general they are low in fertility and are highly erodible. The Brickel and Moscow soils are examples.

Soils that formed in volcanic ash are high in content of silt and very fine sand, are low in fertility, and have a low bulk density. The Hardesty soils are examples.

Soils that formed in stream sediments are stratified, and most are fertile. They are high in content of silt because the alluvium was derived from loess, volcanic ash, or a mixture of the two. The Mondovi and Narcisse soils are examples.

The only soils that formed in organic material are those of the Semiahmoo series. These soils are dark colored. They consist of organic matter in various stages of decomposition.

Climate

Temperature and moisture determine the rate at which minerals are weathered and removed from the soil and the depth at which soluble materials and the fine-textured, in-

soluble materials accumulate within the soil. They also determine, to a great extent, the amount and kind of vegetation that grows and the rate at which vegetation decomposes.

The annual precipitation in Spokane County ranges from 15 to 47 inches, and the amount is greatest on Mount Spokane. Except for increases due to differences in elevation, as on Mount Spokane, the amount of precipitation increases from west to east—from 15 inches in the southwestern part of the county to about 25 inches on the Idaho boundary.

Precipitation is lowest in July and August, gradually reaches a maximum in midwinter, decreases in the spring, and increases slightly in May and June. Most of the winter precipitation is in the form of snow. Warm winds and rain often melt the snow rapidly, and, if the soil underneath is frozen, much of the moisture is lost by runoff. In general, the steeper the slope the more water is lost and the less will be available to contribute to the weathering and leaching of the soil.

In most of the county, the average air temperature in January is about 25° F. and the average July temperature about 69°. Most of the precipitation falls during the cooler periods of the year. Almost all of the soils are dry, or nearly so, during the warm months. Consequently, chemical weathering proceeds more slowly than it would if more precipitation fell during the warm months. Only in old soils, such as those of the Dearyton, Freeman, Garfield, Nez Perce, and Reardan series, has there been appreciable weathering of silt to clay.

Precipitation is sufficient throughout the county to remove calcium carbonate (lime) and more soluble substances completely from many of the soils and to remove it from the upper layers of all the soils except the Lance. Even in Lance soils, lime is not present above a depth of about 8 inches, except where the soils are eroded.

Where the annual precipitation amounts to more than 21 inches, lime has been leached from most of the soils, but in some soils small amounts of lime occur several feet below the surface on peds and on the underside of pebbles and cobblestones. Where annual precipitation is 15 to 21 inches, lime is generally present at a depth of 24 to 60 inches, except in Lance soils. Nez Perce, Athena, Cedonia, Cheney, Lance, and Reardan soils are the only ones in the county that contain significant quantities of free lime.

In general, the greater the amount of precipitation, the more strongly leached are the soils. This leaching is reflected not only in depth to lime or in the complete removal of it, but in the pH and the base saturation. Moscow soils receive 20 to 27 inches of precipitation annually and have a pH ranging from 5.1 to 5.8; Bong, Athena, and Cheney soils receive 15 to 18 inches annually and have a pH ranging from 6.6 to 8.6. The base saturation is probably about 50 percent in Moscow soils and 90 to 100 percent in Bong, Athena, and Cheney soils.

Topography

Topography affects runoff and drainage and thus governs the amount of water that enters the soil. In a level or nearly level area where water neither runs off nor accumulates, all of the rainwater, except what is lost through evaporation or transpiration, enters the soil. In a depression where water accumulates, the amount that enters the soil is greater than in a level area that receives the same amount of rainfall; on a slope where water runs off, the amount is less. The greater the amount of water that enters the soil, the greater the depth to which the soil is leached and weathered.

The topography of Spokane County ranges from level to very steep; depressions occur in some places. An example of the effect of the topography on soils can be found in the soils of the Nez Perce series, which range from level to sloping. In most of the level and nearly level soils of this series, the A1 horizon is 18 to 20 inches thick, the A2 horizon is 5 to 10 inches thick, and the B2t horizon consists of silty clay or clay. In the sloping soils, the A1 horizon is only 14 or 15 inches thick, the A2 horizon is only 1 or 2 inches thick, and the B2t horizon consists of heavy silty clay loam.

Differences in depth to lime also result from differences in topography. In the level and nearly level soils of the Athena series, for example, the depth to lime is more than 48 inches, but in the steep soils of this series, it is about 24 inches. Aspect as well as slope affect the depth to lime. Typically, lime is leached to a greater depth on north-facing slopes than on south-facing slopes, largely because water evaporates more slowly on the north-facing slopes and more water penetrates the soil.

Through its effect on drainage, topography also affects the color of soils. The Cocolalla soils, which are in depressions and are poorly drained, are mottled within 26 inches of the surface. Except for the yellowish and reddish mottles, they have dull colors throughout because they are saturated much of the time. In contrast, nearby soils that are well drained have brighter colors and are unmottled.

Living organisms

Plants, micro-organisms, earthworms, man, and other forms of life are important in determining the rate and direction of soil formation. The most obvious effect of vegetation is the addition of organic matter, which tends to darken the color and to promote a granular structure. In addition, vegetation provides protection against loss of water through runoff and evaporation. Plant roots help keep the soil supplied with bases by returning them from a lower depth to the surface.

Three major vegetative associations have been dominant in Spokane County. They are responsible for certain properties many of the soils have in common and for differences in properties among different soils. The three associations are (1) bunchgrasses, mainly bluebunch wheatgrass and Idaho fescue; (2) open stands of conifers, mainly ponderosa pine, that have an understory of grass; and (3) coniferous forests that consist mainly of lodgepole pine, Douglas-fir, larch, balsam fir, white pine, and western redcedar and have little or no grass understory.

Athena, Cheney, Naff, Palouse, and other soils that formed under bunchgrasses have a thick, dark-colored A horizon, mainly of granular structure. This horizon is about 12 to 20 inches thick and is very dark grayish brown to black. The content of organic matter is 3 to 5 percent. The ratio of carbon to nitrogen is narrow, generally 16 or less.

Hesseltine, Springdale, Cedonia, and other soils that formed under open stands of conifers have a thin A horizon that is lighter in color than the A horizon of soils formed

under grass alone. In uncultivated areas the A horizon ranges from dark grayish brown to very dark grayish brown and is about 3 to 8 inches thick. Generally, the content of organic matter is 1 to 3 percent. The ratio of carbon to nitrogen is intermediate, generally between 16 and 25.

Soils that formed under dense stands of conifers have a very thin A horizon or none at all. Bonner soils, for example, have no A horizon. Eloika soils have no A horizon in some places and one that is only an inch or two thick in others. Hagen soils have an A horizon that is 1 to 4 inches thick. In these soils the content of organic matter is as much as 10 percent, but the organic matter is concentrated in a thin surface layer. Where the A horizon is present, the ratio of carbon to nitrogen is wide, generally more than 25.

Man has drastically altered soils, especially the upper layers, by clearing forests and by plowing and farming grassland. The decrease in organic matter and the accelerated erosion in most of the steeper cultivated soils are obvious evidences of man's influence. On the other hand, soils that formed under trees originally had a thin or light-colored A horizon, but cultivation has resulted in an increase in organic-matter content and a darkening and thickening of the A horizon. For example, Eloika soils that have been farmed generally have a thicker and darker colored surface layer than those that have not.

Time

Time is necessary for the development of soils from parent materials. Other things being equal, old soils have more strongly expressed horizons than young soils. Most of the soils in the county do not have strongly developed horizons.

In most of the county, soil-forming processes have been acting on parent materials since the last glaciation, about 9,000 years ago. Since then, however, loess and volcanic ash have been deposited over much of the landscape, and many soils have been forming for a much shorter period of time.

The bottom lands along streams periodically receive deposits of fresh material; consequently these soils are youthful and have no perceptible horizons other than an A horizon. For example, Narcisse and Mondovi soils have no B horizon or other evidence of soil development because they have not been in place long enough. Their thick, dark-colored surface layer is largely inherited from the parent material, which consists mainly of material eroded from the A horizons of higher lying soils.

Peone and Wethey soils, both of which formed in recent alluvium, have a mottled and gleyed subsoil because of somewhat poor or poor drainage. Otherwise, their characteristics are inherited from the parent material.

Dearyton, Latah, Nez Perce, Reardan, and Freeman soils are, from the standpoint of horizonation, probably the oldest soils in the county. All of these soils have a strong textural B2t horizon, in which there are clay films on ped faces and in pores. All of them, in addition, have a light-colored, strongly leached A2 horizon above the B2t.

Most of the other soils, of which the Cheney soils are typical, are somewhere between the two extremes. Cheney soils have an A horizon of dark-colored silt loam, a silt loam B2 horizon that has weak structure and no evident clay films, and some carbonates in places in the C horizon.

Classification of Soils

Two systems of classifying soils are now in general use in the United States. One is the 1938 system, as later revised and supplemented. The other is the system that was adopted by the Soil Conservation Service in 1965 and is currently in use though still being revised. Both systems consist of six categories. The categories of the 1938 system are the order, suborder, great soil group, family, series, and type. Those of the current system are the order, suborder, great group, subgroup, family, and series.

In this report the soils are classified at the series level and above according to criteria in effect between June 1964 and November 1965. The classification is subject to change. The lower categories of the classification system are discussed in the section "How This Survey Was Made."

In table 8 the soil series in Spokane County are listed alphabetically and classified in the higher categories according to the current and the 1938 classification systems. The orders and suborders of the current system are briefly defined in the text, and the series in each suborder are listed. Following these definitions, detailed profile descriptions of the soil series are given in alphabetical order. A series that is representative of each suborder is identified, and this series is compared with others in the suborder, with special emphasis on the differences brought about by the soil-forming factors.

Entisol order

Soils in this order represent the beginning stages of soil development. They either lack genetic horizons or have only the beginning of horizons. The Entisols in Spokane County are in two suborders, the Psamment and the Orthent.

Psamment suborder.—In this suborder are Entisols that have a texture of loamy fine sand or coarser at a depth of 10 to 40 inches. The Marble series is the only one in this suborder.

Orthent suborder.—The Lance and Wethey series are in this suborder. The Lance series is representative.

Inceptisol order

This order is made up of soils that show only slight evidence of soil development. The horizons are weakly expressed. In general, the soils in this order have weaker horizonation and are less strongly weathered and leached than those of any other order except the Entisol.

The Inseptisols of this county formed in parent material high in content of volcanic ash. The annual precipitation was 15 to 25 inches. The vegetation was mainly either conifers or a mixture of sedges, rushes, and other water-tolerant plants. The Inceptisols of this county are in three suborders, the Aquept, the Andept, and the Ochrept.

Aquept suborder.—In this suborder are soils that are saturated at some period of the year unless they have been artificially drained. The Cocolalla, Peone, and Emdent series are in this suborder. The Cocolalla series is representative.

Andept suborder.—This suborder consists of soils whose parent material consisted mainly of volcanic ash. One soil series, the Hardesty, is in this suborder.

Ochrept suborder.—The Bernhill, Cedonia, Green Bluff, Laketon, and Wolfeson series are in this suborder. The Bernhill series is representative.

TABLE 8.—*Soil series classified according to the current and the 1938 systems of classification*

Series	Current classification				1938 classification	
	Family	Subgroup	Suborder	Order	Great soil group	Order
Athena	Fine silty, mixed, mesic	Andic Haplustoll [2]	Ustoll	Mollisol	Chernozem	Zonal.
Bernhill	Coarse loamy, mixed, mesic.	Andic Dystric Eutrochrept.	Ochrept	Inceptisol	Gray-Brown Podzolic.	Zonal.
Bong	Coarse loamy, mixed, mesic.[1]	Typic Haplustoll	Ustoll	Mollisol	Chernozem	Zonal.
Bonner	Coarse loamy over sandy and sandy skeletal, mixed, mesic.	Typic Normorthod	Orthod	Spodosol	Brown Podzolic	Zonal.
Brickel	Loamy skeletal, mixed	Haplic Cryoboroll	Boroll	Mollisol	Subarctic Brown Forest.	Intrazonal.
Bridgeson	Fine silty, mixed, noncalcareous, mesic.	Andic Haplaquoll [2]	Aquoll	Mollisol	Humic Gley	Intrazonal.
Caldwell	Fine silty, mixed, noncalcareous, mesic.	Andic Cumulic Haplaquoll.[2,3]	Aquoll	Mollisol	Humic Gley	Intrazonal.
Cedonia	Coarse silty, mixed, mesic.	Andic Dystric Eutrochrept.	Ochrept	Inceptisol	Brown Forest	Intrazonal.
Cheney	Coarse loamy over sand and sandy skeletal, mixed, mesic.	Andic Haplustoll [2]	Ustoll	Mollisol	Chernozem	Zonal.
Clayton	Coarse loamy, mixed, mesic.	Typic Normorthod	Orthod	Spodosol	Brown Podzolic	Zonal.
Cocolalla	Ashy, nonacid, mesic	Mollic Andaquept	Aquept	Inceptisol	Humic Gley	Intrazonal.
Dearyton	Fine, mixed, mesic	GlossoboricMollandeptic Normudalf.	Udalf	Alfisol	Gray-Brown Podzolic.	Zonal.
Dragoon	Fine loamy, mixed, mesic.	Andic Argiustoll [2]	Ustoll	Mollisol	Brunizem	Zonal.
Eloika	Coarse loamy, mixed, mesic.	Typic Normorthod	Orthod	Spodosol	Brown Podzolic	Zonal.
Emdent	Ashy, calcareous, mesic.	Aeric Mollic Andaquept.	Aquept	Inceptisol	Solonchak	Intrazonal.
Freeman	Fine silty, mixed, mesic	Glossoboric Mollandeptic Normudalf.	Udalf	Alfisol	Gray-Brown Podzolic.	Zonal.
Garfield	Fine silty, mixed, mesic	Mollic Normudalf	Udalf	Alfisol	Brunizem	Zonal.
Garrison	Loamy skeletal, mixed, mesic.	Andic Haploxeroll [2]	Xeroll	Mollisol	Brunizem	Zonal.
Glenrose	Fine loamy, mixed, mesic	Typic Argixeroll	Xeroll	Mollisol	Brunizem	Zonal.
Green Bluff	Coarse silty, mixed, mesic	Andic Dystrochrept	Ochrept	Inceptisol	Brown Forest	Intrazonal
Hagen	Sandy, mixed, mesic	Typic Normorthod	Orthod	Spodosol	Brown Forest	Intrazonal.
Hardesty	Ashy, mesic	Typic Mollandept	Andept	Inceptisol	Brown Forest	Intrazonal.
Hesseltine	Coarse loamy over sandy and sandy skeletal, mixed, mesic.	Andic Argixeroll [2]	Xeroll	Mollisol	Gray-Brown Podzolic.	Zonal.
Konner	Fine loamy, mixed, mesic	Andic Cumulic Argiaquoll.[2]	Aquoll	Mollisol	Humic Gley	Intrazonal.
Lakesol	Coarse silty, mixed, mesic	Andic Haploxeroll [2]	Xeroll	Mollisol	Brown Forest	Intrazonal.
Laketon	Coarse silty, mixed, mesic	Andic Dystric Eutrochrept.	Ochrept	Inceptisol	Brown Podzolic	Zonal.
Lance	Fine silty, mixed, mesic	Andic Haplorthent	Orthent	Entisol	Regosol	Azonal.
Larkin	Fine silty, mixed, mesic	Andic Argixeroll [2]	Xeroll	Mollisol	Gray-Brown Podzolic.	Zonal.
Latah	Fine, montmorillonitic, mesic.	Andic Cumulic Argialboll.[2]	Alboll	Mollisol	Planosol	Intrazonal.
Marble	Sandy, siliceous, nonacid, mesic.	Alfic Normipsamment	Psamment	Entisol	Brown Forest	Intrazonal.
Mondovi	Coarse silty, mixed, mesic	Andic Cumulic Haplustoll.[2]	Ustoll	Mollisol	Alluvial	Azonal.
Moscow	Coarse, loamy, mixed, mesic.	Typic Normorthod	Orthod	Spodosol	Brown Podzolic	Zonal.
Naff	Fine silty, mixed, mesic	Typic Argixeroll	Xeroll	Mollisol	Brunizem	Zonal.
Narcisse	Coarse silty, mixed, mesic.	Andic Cumulic Haploxeroll.[2]	Xeroll	Mollisol	Alluvial	Azonal.
Nez Perce	Fine, montmorillonitic, mesic.	Typic Argialboll	Alboll	Mollisol	Planosol	Intrazonal.
Palouse	Fine silty, mixed, mesic	Typic Haploxeroll	Xeroll	Mollisol	Brunizem	Zonal.
Peone	Ashy, nonacid, mesic	Mollic Andaquept	Aquept	Inceptisol	Alluvial	Azonal.
Phoebe	Coarse loamy, mixed, mesic.	Typic Haploxeroll	Xeroll	Mollisol	Brunizem	Zonal.
Reardan	Fine, montmorillonitic, mesic.	Andic Argiustoll [2]	Ustoll	Mollisol	Planosol	Intrazonal.

See footnotes at end of table.

TABLE 8.—*Soil series classified according to the current and the 1938 systems of classification*—Continued

Series	Current classification: Family	Subgroup	Suborder	Order	1938 classification: Great soil group	Order
Schumacher	Fine loamy, mixed, mesic	Andic Argixeroll [2]	Xeroll	Mollisol	Gray-Brown Podzolic.	Zonal.
Semiahmoo	Categories between series and order not developed in current system.			Histisol	Bog	Intrazonal.
Snow	Coarse silty, mixed, mesic.	Andic Cumulic Haploxeroll. [2]	Xeroll	Mollisol	Brunizem	Zonal.
Speigle	Loamy skeletal, mixed, mesic.	Andic Haploxeroll [2]	Xeroll	Mollisol	Brown Forest	Intrazonal.
Spokane	Coarse loamy, mixed, mesic.	Typic Haploxeroll	Xeroll	Mollisol	Brown Forest	Intrazonal.
Springdale	Sandy skeletal, mixed, mesic.	Andic Entic Haploxeroll. [2]	Xeroll	Mollisol	Brown Forest	Intrazonal.
Tekoa	Loamy skeletal, mixed, mesic.	Typic Argixeroll	Xeroll	Mollisol	Gray-Brown Podzolic.	Zonal.
Uhlig	Coarse loamy, mixed, mesic.	Andic Haploxeroll [3]	Xeroll	Mollisol	Brunizem	Zonal.
Vassar	Coarse loamy, mixed, frigid.	Typic Normorthod	Orthod	Spodosol	Brown Podzolic	Zonal.
Wethey	Sandy, mixed, mesic	Aquic Cumulic Haplorthent.	Orthent	Entisol	Alluvial	Azonal.
Wolfeson	Coarse loamy, mixed, mesic.	Andic Aquic Dystrochrept.	Ochrept	Inceptisol	Brown Forest	Intrazonal.

[1] Part of series, as now defined, may be in sandy, mixed, mesic family (those underlain by sand above a depth of about 24 inches).
[2] Further study may show that these soils do not belong in the andic subgroup.
[3] Does not meet present (June 1965) mottling requirement in lower part of mollic epipedon, but otherwise fits this class.

Mollisol order

Soils in this order have a thick, dark-colored surface layer containing at least 1 percent more organic matter than the C horizon. The Mollisols in Spokane County formed in a variety of parent materials, but all are presumed to contain detectable amorphous colloids or to be more than 20 percent volcanic ash. The vegetation was grass, grass and conifers, or rushes, sedges, and other water-tolerant plants. The annual precipitation is 15 to 45 inches. More than half of the soil series in Spokane County are classified as Mollisols. They are in five suborders—The Alboll, the Aquoll, the Boroll, the Xeroll, and the Ustoll.

Alboll suborder.—This suborder consists of soils that have a strongly leached, light-colored A2 horizon and a strongly developed, mottled B2t horizon. The Latah and Nez Perce series are classified as Albolls. The Nez Perce series is representative.

Aquoll suborder.—This suborder is made up of soils that are saturated at some season of the year unless they are artificially drained and that lack an A2 horizon. The Bridgeson, Caldwell, and Konner series are in this suborder. The Bridgeson series is representative.

Boroll suborder.—The soils in this suborder have a mean annual soil temperature of 47° F. The colors are dull (a chroma of 1.5 or less) to a depth of 6 inches. One soil series, the Brickel, is in this suborder.

Xeroll suborder.—In this suborder are soils that are seasonally dry in the B horizon or in some part of the A horizon for 60 consecutive days in most years. In addition, either there is no increase in sodium and potassium with depth or the exchange acidity is in excess of sodium and potassium. (See laboratory data for Springdale gravelly sandy loam on page 134.) Most of these receive more than 18 inches of precipitation annually. Some areas of Hesseltine, Speigle, Springdale, and Uhlig soils receive slightly less than 18 inches.

The soil series in this suborder are the Garrison, Glenrose, Hesseltine, Lakesol, Larkin, Naff, Narcisse, Palouse, Phoebe, Schmacher, Snow, Speigle, Spokane, Springdale, Tekoa, and Uhlig. The Uhlig series is representative.

Ustoll suborder.—This suborder consists of soils much like those in the Xeroll suborder, except that the content of sodium and the content of potassium increase with depth and are in excess of the exchange acidity. The annual precipitation is between 15 and 18 inches; consequently, these soils are less leached than Xerolls. The series in the Ustoll suborder are the Athena, Bong, Dragoon, Mondovi, and Reardan. The Athena series is representative.

Spodosol order

The soils in this order have, at or near the surface, a horizon in which iron and aluminum oxides have accumulated along with some organic carbon but with little or no additional clay. This horizon is called a spodic horizon. It is approximately equivalent to a Bir horizon. The annual precipitation was 20 to 45 inches. The vegetation was a coniferous forest. The Spodosols in Spokane County are in the Orthod suborder.

Orthod suborder.—In the soils of this suborder the uppermost 0.4 inch of the spodic horizon either is 1 percent or more Fe_2O_3 and 0.5 percent or more organic matter or is more than 1 percent organic matter and between 0.5 per-

cent and 1 percent Fe_2O_3. The Bonner, Clayton, Eloika, Hagen, Moscow, and Vassar series are in this suborder. The Bonner series is representative.

Alfisol order

The soils in this order are strongly weathered and have a dark-colored surface layer. The surface layer is too thin for the soils to be classified in the Mollisol order, although it is dark colored enough and contains enough organic matter.

The Alfisols in Spokane County formed under annual precipitation of 18 to 23 inches. They are in the Udalf suborder.

Udalf suborder.—The soils in this suborder are seasonally dry for more than 60 days in most years. They have a strongly developed B2 horizon. The Dearyton, Freeman, and Garfield series are in this suborder. The Freeman series is representative.

Histosol order

This order is made up of soils that have a large amount of organic matter in the surface horizon. No categories between the order and the series have been proposed. One series in Spokane County, the Semiahmoo, is in this order.

Descriptions of soil profiles

In this subsection the profiles of all the series in Spokane County are described in alphabetical order. The series that are representative of their suborders are identified and are compared with other series in the suborders. Table 8 on page 109 shows the classification of each series by the current system and by the 1938 system with later revisions.

Technical terms are defined in the Soil Survey Manual (*10*) and in the Glossary of this report. The combinations of letters and numbers at the left of the profile description designate the horizons in the profile. The letters and numbers in parentheses identify the color of the soil in terms of hue, value, and chroma, according to the Munsell color system.

ATHENA SERIES

The Athena series is representative of the Ustoll suborder, a division of the Mollisol order. Following the profile description and the range of characteristics below, this series is compared with the Bong, Cheney, Dragoon, Mondovi, and Reardan soils, which are also in the Ustoll suborder.

Profile of Athena silt loam, cultivated, in SE¼NE¼NW¼ sec. 29, T. 26 N., R. 40 E., W.M., 400 feet east of Stroup Road in a cultivated field, 5½ miles north of U.S. Highway No. 2—

Ap—0 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.6); abrupt, smooth boundary. 8 to 11 inches thick.

A1—10 to 18 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; neutral (pH_5 6.7); gradual, wavy boundary. 4 to 10 inches thick.

B2—18 to 28 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; most mineral grains are thinly stained; mildly alkaline (pH_5 7.4); clear, wavy boundary. 6 to 8 inches thick.

B3ca—28 to 44 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; many fine pores; many clean mineral grains; strongly effervescent, lime is segregated in tubular pores and adjacent areas; strongly alkaline (pH_5 8.6); gradual, wavy boundary. 12 to 20 inches thick.

Cca—44 to 60 inches +, very pale-brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few roots; many fine pores; most mineral grains are clean; strongly effervescent, lime being both disseminated and segregated in tubular pores; moderately alkaline (pH_5 8.4). 12 to 20 inches thick.

The upper part of the A horizon, when moist, ranges from very dark brown to nearly black. The B2 horizon is silt loam or heavy silt loam. The depth to lime is 24 to more than 60 inches. In places, small amounts of very coarse granitic and basaltic sand and pea-sized gravel are present in the B and C horizons.

Considerable organic matter has accumulated in the surface layer and accounts for the dark color of the uppermost 18 inches and the granular structure of the uppermost 10 inches. Lime and some bases have been leached from the uppermost 28 inches. In the profile described, free lime is present at a depth of 28 inches. In the nearly level Athena soils in the county, lime has been removed to a depth of 4 or 5 feet or more. Moderate structure in the B horizon indicates shrinking and swelling of the soil with change in moisture content. The B horizon lacks clay films and contains about the same amount of clay as the A horizon, or slightly more; these facts suggest that only small amounts of clay have been moved from the A horizon to the B or have formed in place in the B horizon. This is attributed to the youthfulness of the parent material and to the fact that the parent material was high in carbonates, which retard clay movement.

Bong and Cheney soils are similar to Athena soils in horizonation and evidence of development but have a thinner solum and a weaker structure in the B horizon because they formed in coarse-textured parent material more resistant to weathering and lower in shrink-swell potential. Lime has been removed from the Bong soils and in most places from the Cheney soils because water moves through these more rapidly than through the Athena soils and the parent material contained less lime than that of Athena.

Dragoon soils have a moderately developed B2t horizon that contains more clay than the A horizon. They have a thinner solum than the Athena soils because bedrock is at a moderate depth.

Mondovi soils are dark colored throughout because the parent material consists largely of the surface horizon of nearby eroded soils on uplands. These soils are young; consequently, the subsoil structure is weak, little leaching of bases has taken place, and other evidences of soil development are lacking. No lime is present, as the parent material was free of lime.

Reardan soils apparently formed in parent material deposited in layers over long periods, as did the Nez Perce

soils, which are in the Alboll suborder. The principal differences between the soils of these two series result from differences in precipitation and are reflected in thickness of the A1 and A2 horizons and in depth to lime. In similar topographic positions, the A1 horizon of Reardan soils is slightly lighter colored and thinner than the A1 horizon of Nez Perce soils, and the A2 is also slightly thinner. Lime is present in Reardan soils at a depth of 30 to 50 inches. Nez Perce soils are free of lime except in a few places where it has been found below 40 inches.

BERNHILL SERIES

The Bernhill series is representative of the Ochrept suborder, a division of the Inceptisol order. Following the profile description and range of characteristics below, this series is compared with the Cedonia, Green Bluff, Laketon, and Wolfeson series, all of which are also in the Ochrept suborder.

Profile of Bernhill silt loam, cultivated, 250 feet west and 50 feet north of the intersection of Hazard and Dalton Roads in SE¼SE¼NW¼ sec. 26, T. 27 N., R. 42 E., W.M.—

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; slightly acid (pH_5 6.4); abrupt, smooth boundary. 6 to 9 inches thick.

A3—8 to 16 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and few fine pores; few dark-brown (7.5YR 4/4), thin, discontinuous clay films on ped surfaces; slightly acid (pH_5 6.4); clear, wavy boundary. 6 to 10 inches thick.

B1t—16 to 29 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and few fine pores; few, thin, dark-brown, clay films; neutral (pH_5 6.6); clear, wavy boundary. 10 to 14 inches thick.

B2t—29 to 45 inches, pale-brown (10YR 6/3) heavy loam, dark brown (10YR 4/3) when moist; moderate, coarse, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine and few fine pores; thin, continuous, dark-brown (7.5YR 3/4) clay films and few coatings of clean mineral grains on prism faces; clay accumulation appears in wavy, irregular bands and bridges between mineral grains; neutral (pH_5 6.6); gradual, wavy boundary. 10 to 24 inches thick.

C1—45 to 60 inches +, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few roots; many very fine pores; few, thin, dark-brown (7.5YR 3/4) clay films on ped faces; neutral (pH_5 6.8).

In undisturbed areas a thin O horizon is present. The A1 horizon is grayish brown or brown and is very dark grayish brown or very dark brown when moist. The B2t horizon is heavy loam or heavy silt loam. Horizontal, irregular, wavy bands of finer texture than the matrix are common. In places more than 50 percent of the C horizon consists of gravel, cobblestones, and stones, and in places the soil is gravelly or stony throughout. Bedrock may occur at a moderate depth. Laminated lacustrine sediments may be present below the B horizon.

Additions of organic matter are responsible for the dark color and the granular and subangular blocky structure of the Ap and A3 horizons. Weak, subangular blocky structure and moderate, prismatic structure have formed in the B and C horizons as a result of alternate shrinking and swelling of the soil material. The thin clay films on ped faces in the B1t, B2t, and C1 horizons indicate that some clay has moved from the upper horizons. The pH increases with depth, indicating greater leaching of bases from the upper horizons than from those below.

Cedonia soils are similar to Bernhill soils in horizonation and profile development but have a higher pH throughout and are calcareous below a depth of about 12 inches because their parent material was calcareous. In addition, they lack clay films, mainly because lime tends to retard movement of clay.

Green Bluff soils are mottled in the B and C horizons as a result of impeded drainage. In some places thin, discontinuous clay films have been observed on ped faces in the B horizon. Thin, irregular, wavy bands that contain more clay and iron than the material above and below are in the B horizon in some places.

Laketon soils are much like Bernhill soils, but as a result of a more sparse cover of grass, the Laketon soils generally have a dark grayish-brown rather than a very dark grayish-brown A horizon. Also the Laketon soils lack clay films in the B horizon because the parent material contains fewer minerals that weather into clay. These soils are mottled in the B and C horizons because of impeded drainage, and they are underlain by a buried soil.

Wolfeson soils, too, resemble Bernhill soils but lack structure in the B horizon because the material is moderately coarse textured and shrinks and swells slightly upon drying and wetting. A few thin clay films are present in bands and pores in the B horizon, and the B horizon is mottled. Wolfeson soils, like Laketon soils, are underlain by a buried soil.

BONG SERIES

The Bong series is in the Ustoll suborder, a division of the Mollisol order. Profile of Bong fine sandy loam, cultivated, 0.2 mile north and 50 feet west of junction of Dover Road and Sunset Highway in SE¼SE¼ sec. 20. T. 25 N., R. 41 E., W.M.—

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; neutral (pH_5 6.6); clear, smooth boundary. 10 to 15 inches thick.

B2—11 to 22 inches, yellowish-brown (10YR 5/4) sandy loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; many fine pores; neutral (pH_5 6.8); clear, wavy boundary. 8 to 15 inches thick.

IIC1—22 to 28 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; few fine pores; neutral (pH_5 6.8); abrupt, wavy boundary. 6 to 20 inches thick.

IIC2—28 to 60 inches, multicolored, coarse basalt and quartz sand; single grain; loose when dry, nonsticky and nonplastic when wet; no roots; neutral (pH_5 6.8).

The A1 horizon, when moist, is very dark brown to very dark grayish brown. The texture is fine sandy loam to

coarse sandy loam. The B2 horizon ranges from dark yellowish brown to brown (7.5YR hue) in color and from fine sandy loam to coarse sandy loam in texture. The depth to the underlying coarse and very coarse sand ranges from 20 to 40 inches. A few stones and pebbles may occur in the solum.

BONNER SERIES

The Bonner series is representative of the Orthod suborder, a division of the Spodosol order. Following the profile description and range of characteristics below, this series is compared with the Clayton series, which is also a member of the Orthod suborder. Other series in the suborder are the Eloika, Hagen, Moscow, and Vassar.

Profile of Bonner silt loam in woodland 100 feet north of Bridges Road and 2,530 feet east of the intersection of U.S. Highway 195 and Bridges Road in W½SE¼SE¼SW¼ sec. 11, T. 29 N., R. 43 E., W.M.—

O1—1 inch to 0, very dark grayish-brown, loose partly decomposed organic litter composed of needles, leaves, and twigs; medium acid (pH_5 6.0); abrupt, smooth boundary.

A1—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.6); abrupt, smooth boundary. 0 to 3 inches thick.

B21ir—2 to 10 inches, light yellowish-brown (10YR 6/4) silt loam, dark brown (7.5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; few fine pores; neutral (pH_5 6.6); abrupt, smooth boundary. 6 to 10 inches thick.

B22ir—10 to 20 inches, light yellowish-brown (10YR 6/4) gravelly loam, dark brown (7.5YR 3/4) when moist; common, fine, dark-brown (7.5YR 4/4) mottles; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common fine pores; slightly acid (pH_5 6.2); gradual, wavy boundary. 8 to 12 inches thick.

B3ir—20 to 26 inches, light yellowish-brown (10YR 6/4) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) when moist; many, medium, dark-brown (7.5YR 4/4) mottles; massive; loose when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; slightly acid (pH_5 6.4); abrupt, smooth boundary. 4 to 10 inches thick.

C—26 to 60 inches, multicolored gravelly coarse sand; single grain; loose when dry, nonsticky and nonplastic when wet; few roots; neutral (pH_5 6.8).

The texture of the upper part of the solum ranges from fine sandy loam to silt loam. In places the solum is gravelly. The depth to gravelly sand is 18 to 36 inches. A thin A2 horizon is present above the Bir horizon in some places.

The principal evidences of soil development are the thin granular A1 horizon, the slightly acid reaction indicating removal of bases, and the spodic horizon which, in the profile described, is 24 inches thick. In places there is an incipient A2 horizon as a result of water moving through the acid litter. This process has reduced iron compounds and stripped colloids from the surface of mineral grains.

Other soils in this suborder are similar to the Bonner soils in horizonation and development. Clayton soils have irregular, wavy bands in the C2, C3, and C4 horizons. These bands contain more iron and clay than the adjacent material does. (See laboratory data in the subsection "Chemical and Physical Properties of Soils.") The origin of the bands has been explained briefly under Entisols.

Although the precise process in the forming of the spodic horizon is not clearly understood, some general statements can be made. For the horizon to form, the following conditions apparently are necessary: An acid litter must be present on the surface. In Spokane County this litter accumulates under conifers. Sufficient precipitation must fall to leach the litter and upper part of the soil material. The parent material must contain minerals that will release iron and aluminum upon weathering.

The spodic horizon in Spokane County soils ranges from 5 to 40 inches in thickness, from sandy loam to silt loam in texture, and from dark brown to dark yellowish brown in color when moist. This horizon is friable or very friable. Generally it is either massive or has a weak structure. The reaction ranges from neutral to medium acid. The spodic horizon in Spokane County is weakly expressed, compared to those in many soils elsewhere. It is distinguished from the horizon immediately above it and below it mainly by its brighter color. The variation in thickness of the spodic horizon in Spokane County soils is not easily explained. Probably the thickness is determined mainly by the amount of easily weathered, iron-bearing minerals in the parent material.

BRICKEL SERIES

The Brickel series is the only series in the county in the Boroll suborder, a division of the Mollisol order. Profile of Brickel stony loam in grassland 0.2 mile east of junction of Summer and Day-Mount Spokane Roads and 20 feet north of Summer Road in NE¼NE¼NW¼ sec. 21, T. 28 N., R. 45 E., W.M.—

A11—0 to 6 inches, dark-gray (10YR 4/1) stony loam, black (10YR 2/1) when moist; moderate, fine, granular structure; soft when dry, very friable when moist, nonplastic and slightly sticky when wet; abundant roots; porous; slightly acid (pH_5 6.2); clear, wavy boundary. 6 to 8 inches thick.

A12—6 to 13 inches, dark grayish-brown (10YR 4/2) stony loam, very dark brown (7.5YR 2/2) when moist; weak, fine, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and few fine pores; slightly acid (pH_5 6.2); clear, wavy boundary. 4 to 6 inches thick.

B2—13 to 22 inches, brown (7.5YR 5/4) very cobbly loam, dark brown (7.5YR 3/4) when moist; moderate, fine, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; slightly acid (pH_5 6.2); gradual, wavy boundary. 7 to 12 inches thick.

C1—22 to 30 inches, pale-brown (10YR 6/3) very cobbly sandy loam, dark brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few roots; porous; slightly acid (pH_5 6.2). 4 to 10 inches thick.

R—30 inches +, fractured, fine-grained gneiss.

The A1 horizon, when moist, is black to very dark brown. It ranges from 10 to 14 inches in thickness and is loam or silt loam in texture. In places from 50 to 90 percent of the B2 horizon consists of gravel, cobblestones, and stones. The organic matter appears to be in the form of very fine aggregates, but the mineral grains are generally stained. The depth to bedrock is 14 to 36 inches.

Organic matter is the cause of the dark color and the granular and subangular blocky structure of the A11 and A12 horizons. The moderate subangular blocky structure of the B2 horizon has probably formed as a result of expansion and contraction brought about by freezing and thawing. In part it may be remnants of rock structure. The B2 horizon is a very cobbly loam that has a low shrink-swell potential. Consequently, shrinking and swelling have not contributed to formation of structure. Brickel soils are slightly acid throughout, which indicates that the bases have been removed by leaching, that the parent material was low in bases, or both.

BRIDGESON SERIES

The Bridgeson series is representative of the Aquoll suborder, a division of the Mollisol order. Following the profile description and the range of characteristics below, this series is compared with the Caldwell and Konner series, which are also in the Aquoll suborder.

Profile of Bridgeson silt loam in pasture 200 feet west of Bridge 2907 on Grove Road in NE¼SE¼SE¼ sec. 21, T. 29 N., R. 42 E., W.M.—

Ap—0 to 12 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, fine and medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH 7.0); clear, smooth boundary. 6 to 12 inches thick.

C1—12 to 20 inches, light-gray (10YR 6/1) heavy silt loam, dark gray (10YR 4/1) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common very fine and fine pores; few, fine, dark-brown (7.5YR 4/4) mottles; neutral (pH 7.1); clear, wavy boundary. 6 to 8 inches thick.

C2g—20 to 31 inches, light-gray (10YR 6/1) light silty clay loam, dark gray (10YR 4/1) when moist; moderate, fine and medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; many very fine and few fine pores; few, fine, dark-brown (7.5YR 4/4) mottles; neutral (pH 7.2); clear, smooth boundary. 10 to 14 inches thick.

C3g—31 to 40 inches, light-gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) when moist; moderate, fine and medium, subangular blocky structure; hard when dry, very firm when moist, sticky and plastic when wet; plentiful roots; many very fine and few fine pores; common, medium, dark-brown (7.5YR 4/4) mottles; few thin clay films in pores; neutral (pH 7.0); abrupt, smooth boundary. 8 to 12 inches thick.

C4g—40 to 60 inches +, light-gray (10YR 6/1) heavy silty clay loam, dark gray (10YR 4/1) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; common very fine pores; common, medium bluish-gray mottles, few black stains on peds; neutral (pH 7.0).

The A1 horizon ranges from very dark brown to black in color. Mottles may occur near the surface and are few or common and distinct or prominent. The texture of the C horizon is clay loam or silty clay loam. Lenses of sand or pumicite are common.

The dark color and granular structure of the Ap horizon are attributed to an accumulation of organic matter. Dull colors are the result of poor drainage; however, the mottles indicate that the water table fluctuates and that the soil is not satuated all the time. The moderate and strong structure in the C horizon formed from the shrinking and swelling of the soil material when it was alternately dry and wet. That Bridgeson soils have not been leached appreciably is shown by the fact that the entire profile is neutral in reaction.

Caldwell soils are similar to Bridgeson soils in horizonation and development. Caldwell soils have a thicker A horizon, however, because they are near drainageways and periodically receive fresh deposits of soil material. They are slightly more acid than Bridgeson soils, either because they have been leached more or because the parent material was slightly lower in bases.

Konner soils also are much like Bridgeson soils, but their A horizon is thicker because of periodic deposition of sediments. There are clay films on ped surfaces in the B and IIB horizons.

CALDWELL SERIES

The Caldwell series is in the Aquoll suborder, a division of the Mollisol order. Profile of Caldwell silt loam, cultivated, in SW¼SW¼SW¼ sec. 14, T. 22 N., R. 45 E., W. M., near Bridge No. 5203 near junction of South Bradshaw Road and Molter Road—

Ap—0 to 8 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, fine, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH 6.6); abrupt, smooth boundary. 6 to 11 inches thick.

A11—8 to 25 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, fine, platy structure (laminated); slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine and fine pores; neutral (pH 6.6); abrupt, wavy boundary. 15 to 22 inches thick.

A12—25 to 38 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, platy structure, but breaks readily to fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; many very fine and fine pores; few, fine, faint mottles; neutral (pH 6.8); clear, smooth boundary. 10 to 18 inches thick.

IIC1g—38 to 52 inches, gray and light gray (N 5/0 and N 7/0) silty clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; few roots; common very fine and fine pores; common, fine, faint mottles; few thin clay films in pores; neutral (pH 6.8); abrupt, smooth boundary. 10 to 18 inches thick.

IIC2g—52 to 60 inches +, grayish-brown and light grayish-brown (2.5Y 5/2 and 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine and fine pores; common, medium, distinct, dark-brown and strong-brown mottles; few thin clay films in pores; neutral (pH 6.6).

The A horizon, when moist, ranges from very dark grayish brown to black. Mottling varies from faint to distinct at a moderate depth. In places the profile contains some basalt gravel. A buried profile with a weakly developed Bt horizon underlies the A horizon in some places.

CEDONIA SERIES

The Cedonia series is in the Ochrept suborder, which is in the Inceptisol order. Profile of Cedonia silt loam, cultivated, 0.2 mile east of junction of Peone Road and Highland Road, 30 feet north of Peone Road, in the SW¼SW¼ sec. 33, T. 27 N., R. 44 E., W.M.—

Ap—0 to 6 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine platy structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few roots; neutral (pH_5 6.8); abrupt, smooth boundary. 5 to 9 inches thick.

A3—6 to 12 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; many very fine pores; neutral (pH_5 7.0); clear, smooth boundary. 6 to 10 inches thick.

B21—12 to 27 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; many very fine and fine pores; few, fine, dark yellowish-brown (10YR 3/4) coatings in thin bands; slightly effervescent in some root channels; mildly alkaline (pH_5 7.8); clear, wavy boundary. 10 to 20 inches thick.

B22—27 to 33 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; many fine pores; few dark yellowish-brown (10YR 3/4) coatings on thin bands; slightly effervescent; moderately alkaline (pH_5 8.0); clear, smooth boundary. 6 to 10 inches thick.

C—33 to 60 inches +, pale-yellow (5Y 7/3) silt loam, olive (5Y 5/3) when moist; finely laminated; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots along cleavage planes to a depth of about 50 inches; few fine pores; strongly effervescent; strongly alkaline (pH_5 8.6).

The A horizon, when moist, may be very dark grayish brown. The texture of this horizon is very fine sandy loam or silt loam. Thin bands having thin clay films occur in places in the B horizon. The C horizon is moderately or strongly calcareous and is commonly more calcareous with depth.

CHENEY SERIES

The Cheney series is in the Ustoll suborder, a division of the Mollisol order. Profile of Cheney silt loam, cultivated, 3,200 feet south and 50 feet west of junction of Brooks Road and Jacobs Road, in NE¼NE¼SE¼ sec. 36, T. 26 N., R. 40 E., W.M.—

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; neutral (pH_5 6.6); abrupt, smooth boundary. 6 to 11 inches thick.

A1—10 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, coarse, platy structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.7); clear, wavy boundary. 3 to 6 inches thick.

B21—14 to 22 inches, yellowish-brown (10YR 5/4) silt loam, dark brown (10YR 3/4) when moist; weak, medium, prismatic structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and fine pores; neutral (pH_5 7.2); gradual, wavy boundary. 6 to 10 inches thick.

B22—22 to 28 inches, light yellowish-brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse, prismatic structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and fine pores; few, thin, discontinuous colloidal films on some peds; neutral (pH_5 7.2); clear, wavy boundary. 5 to 10 inches thick.

IIC1—28 to 35 inches, pale-brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few roots; porous, effervescent lime coatings on underside of some gravel; mildly alkaline (pH_5 7.6); gradual, wavy boundary. 6 to 12 inches thick.

IIC2—35 inches +, clean gravel and cobblestones, dominantly basalt; few granite and quartzite cobblestones; some gravel and cobblestones have lime coatings.

The A horizon is 12 to 16 inches thick. The B2 horizon may be loam or silt loam and may have a few, thin, patchy clay films on ped faces. Lime may or may not be present in the C horizon. Very coarse sand and fine basaltic gravel are common throughout the solum. The depth to gravel ranges from 20 to 40 inches.

CLAYTON SERIES

The Clayton series is in the Orthod suborder, a division of the Spodosol order. Profile of Clayton fine sandy loam in woodland 380 feet east of junction of Monroe Road and cross-cut road at a point 100 feet south of cross-cut road, in NW¼NW¼NW¼ sec. 34, T. 28 N., R. 42 E.—

O—1 inch to 0, very dark grayish-brown, loose, partly decomposed organic litter composed of needles, leaves, and twigs (pH_5 5.8); abrupt, smooth boundary.

A1—0 to 3 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) when moist; weak, very fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; medium acid (pH_5 6.0); clear, smooth boundary. 2 to 4 inches thick.

B2ir—3 to 9 inches, light yellowish-brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 3/4) when moist; weak, very fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.1); clear, wavy boundary. 5 to 8 inches thick.

C1—9 to 18 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.3); clear, wavy boundary. 8 to 10 inches thick.

C2—18 to 35 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots in upper part, few in lower part; many very fine pores; two distinct, irregular and wavy, dark-brown (10YR 4/3, moist) bands 1/16 to 1/8 inch thick, with thin clay films in pores; neutral (pH_5 6.6); gradual, wavy boundary. 18 to 29 inches thick.

C3—35 to 54 inches, similar to above except texture is loamy fine sand and there are three distinct, wavy and irregular, dark yellowish-brown (10YR 3/4, moist) bands of loam 1/8 to 1/2 inch thick; few roots; gradual, wavy boundary. 15 to 20 inches thick.

C4—54 to 74 inches, pale-brown (10YR 6/3) sand, brown (10YR 4/3) when moist; single grain; loose when dry, nonsticky and nonplastic when wet; very few roots; one distinct, wavy and irregular band of loam, dark yellowish-brown (10YR 3/4) when moist, 1/2 to 2 inches thick, coated by thin clay films; neutral (pH_5 6.8). Rests upon stratified, noncalcareous, silt loam lake sediments at a depth of 74 inches.

The A horizon ranges from brown to dark brown when moist and has a fine granular or platy structure. Organic matter is present in the solum in the form of very fine,

subangular pellets and discrete particles. In the C horizon, discontinuous clay films appear in the pores of medium-textured, wavy bands. The bands range from 1/8 to 2½ inches in thickness, Medium, faint mottles commonly occur in the C horizon. Some fine gravel occurs in the lower part of the profile. The texture in the upper part of the profile is loam, fine sandy loam, sandy loam, or coarse sandy loam, and that of the C horizon is loamy sand or loamy coarse sand.

COCOLALLA SERIES

The Cocolalla series is representative of the Aquept suborder, a division of the Inceptisol order. Following the profile description and the range of characteristics, this series is compared with the Peone and Emdent series, which are also in the Aquept suborder.

Profile of Cocolalla silty clay loam, cultivated, 200 feet north of center and 63 feet west of north-south center line in sec. 30, T. 23 N., R. 41 E., W.M.—

Ap—0 to 5 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; neutral (pH_5 7.0); clear, smooth boundary. 5 to 7 inches thick.

A12—5 to 13 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) when moist; moderate, fine, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; mildly alkaline (pH_5 7.4); abrupt, smooth boundary. 7 to 9 inches thick.

C1g—13 to 20 inches, light-gray (10YR 7/1) silt loam, dark gray (10YR 4/1) when moist; moderate, fine, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and fine pores; occasional krotovinas 1 to 2 inches in diameter; mildly alkaline (pH_5 7.6); clear, smooth boundary. 6 to 8 inches thick.

C2g—20 to 26 inches, light-gray (10YR 7/1) silt loam, dark gray (10YR 4/1) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; occasional krotovinas 1 to 2 inches in diameter; mildly alkaline (pH_5 7.6); clear, wavy boundary. 4 to 8 inches thick.

C3g—26 to 46 inches, white (2.5YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; few roots; few, very fine and fine, tubular pores; few, coarse, distinct, yellowish-brown (10YR 5/4) mottles on cleavage faces and in pores; mildly alkaline (pH_5 7.6); abrupt, smooth boundary. 18 to 22 inches thick.

IIA1b—46 to 56 inches, light-gray (2.5Y 7/2) silty clay loam, very dark gray (10YR 3/1) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; few, very fine, tubular pores; coarse, faint mottles; mildly alkaline (pH_5 7.6); clear, wavy boundary. 8 to 12 inches thick.

IIC1b—56 to 62 inches +, white (N 8/0) clay loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; few, very fine, tubular pores; few, fine, distinct yellowish-brown (10YR 5/6) mottles; mildly alkaline (pH_5 7.6).

The A1 horizon ranges from dark gray to black when moist. It is silty clay loam to silt loam in texture and varies considerably in content of organic matter. In some places it is almost like peat. The C horizon contains one or more layers of pumicite or diatomite ranging in thickness from 2 to 15 inches. The C horizon is stratified and may be silt loam, silty clay loam, or clay loam. Mottling ranges from faint to prominent. The reaction of the soil ranges from slightly acid to mildly alkaline. The depth to bedrock ranges from 3 to more than 6 feet.

Large quantities of organic matter have been added to the surface layer of Cocolalla soils. Laboratory data in the subsection "Chemical and Physical Properties of Soils" show that about 9 percent of the Ap horizon and about 5 percent of the A12 horizon is organic matter. The high percentage of organic matter—probably more than twice as much as that in nearby well-drained soils—is the result of the heavy vegetative growth on these soils during their formation. In addition, decomposition proceeds more slowly in wet soils than in those that are not so wet. The Ap and A12 horizons are platy rather than granular, probably because of compaction by farm machinery. The entire profile is dull colored because of the poor drainage. The mottles in the C3g and underlying horizons indicate that the soil does dry out at times. Base saturation increases below the A12 horizon, indicating that little removal of bases has taken place by leaching. Remnants of a buried A horizon are in the 46- to 56-inch horizon, as shown by the abrupt increase in organic matter in that horizon (0.3 percent compared to 0.07 percent in the layer above).

Peone soils have properties similar to those of the Cocolalla soils. The main differences are in texture and in color of the A horizon. The Peone soils have a lighter colored, coarser textured A horizon. Also, Peone soils do not contain a buried soil.

Emdent soils are very strongly alkaline and calcareous in the upper part. Undoubtedly they contain significant quantities of sodium. The parent material probably was nearly neutral, noncalcareous, and free of sodium. Seepage water, carrying dissolved sodium and lime from adjacent soils, is responsible for the very strongly alkaline and calcareous condition.

DEARYTON SERIES

The Dearyton series is a member of the Udalf suborder, a division of the Alfisol order. Profile of Dearyton silt loam, cultivated, in NW¼NW¼ sec. 26, T. 26 N., R. 44 E., W.M., 0.1 mile east and 30 feet south of junction of Lincoln Road and Forker Road—

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, nearly loam; very dark grayish-brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; soft when dry, very friable when moist, nonsticky and slightly plastic when wet; abundant roots; porous; neutral (pH_5 7.0); clear, smooth boundary. 5 to 8 inches thick.

A2—7 to 11 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, platy structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; porous; neutral (pH_5 6.8); abrupt, smooth boundary. 2 to 7 inches thick.

A&B—11 to 21 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; abundant roots; many very fine pores; clean mineral grains coat ped faces, but there appear to be vestiges of clay films in pores and bridges; slightly acid (pH_5 6.4); gradual, wavy boundary. 3 to 7 inches thick.

A&B—21 to 25 inches, very pale brown (10YR 8/3) loam, brown (10YR 4/3) when moist; otherwise similar to above except it breaks to moderate, fine, subangular blocky structure, and is neutral (pH_5 6.6); abrupt, smooth boundary. 3 to 5 inches thick.

B21t—25 to 38 inches, brown (10YR 5/3) light clay, dark brown (10YR 3/3) when moist; strong, coarse, prismatic structure that breaks to strong, fine, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; few very fine pores; moderately thick, continuous clay films on ped surfaces and in pores; clean, very fine sand grains are conspicuous on structure surfaces and in pores; few dark shots; neutral (pH_5 6.6); gradual, wavy boundary. 10 to 15 inches thick.

B22t—38 to 46 inches, very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) when moist; moderate, fine, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; common very fine pores; moderately thick, continuous clay films on ped surfaces and in pores; many clean mineral grains on fracture surfaces; few dark shots; neutral (pH_5 6.8); clear, irregular boundary. 6 to 13 inches thick.

B3t—46 to 60 inches +, pale-brown (10YR 6/3) gravelly clay loam, brown (10YR 5/3) when moist; massive; very hard when dry, very firm when moist, sticky and plastic when wet; very few roots; common very fine pores; thin, discontinuous clay films on fracture surfaces, and common reddish-brown stains on fracture surfaces; few moderately thick clay films in pores; neutral (pH_5 6.6).

The A1 horizon ranges from very grayish brown to dark brown in color and from silt loam to loam in texture. The B2t horizon is heavy clay loam to silty clay and has moderately thick, continuous or nearly continuous clay films. As much as 30 percent of the B horizon may be gravel. The texture of the C horizon ranges from silty clay loam to gravelly clay loam. This horizon has weak, medium, subangular blocky structure or is massive, and from 10 to 35 percent of the material is gravel. Coarse granitic sand is present throughout the profile, although the texture is nearly silty in many places. Stones may be present in the profile.

DRAGOON SERIES

The Dragoon series is in the Ustoll suborder, a division of the Mollisol order. Profile of Dragoon silt loam, cultivated, 500 feet north of center of NW¼ sec. 21, T. 24 N., R. 41 E., W.M.—

Ap1—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, near loam; very dark brown (10YR 2/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; neutral (pH_5 6.6); abrupt, smooth boundary. 6 to 10 inches thick.

A12—7 to 11 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; few very fine pores; neutral (pH_5 6.6); abrupt, smooth boundary. 5 to 8 inches thick.

B21t—11 to 20 inches, brown (7.5YR 5/4) heavy loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that breaks to weak, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; few very fine pores; few thin clay films on ped faces and in pores; one wavy dark-brown clay band ⅜ inch to ½ inch thick; neutral (pH_5 6.6); clear, wavy boundary. 6 to 12 inches thick.

B22t—20 to 27 inches, brown (10YR 5/3) heavy loam, dark brown (7.5YR 3/4) when moist; moderate, medium, prismatic structure; hard when dry, firm when moist, sticky and very plastic when wet; plentiful roots; few very fine pores; common thin clay films in pores; neutral (pH_5 6.6); gradual, wavy boundary. 5 to 8 inches thick.

IIC1—27 to 36 inches, variegated dark yellowish-brown, brown, and light-gray coarse sandy loam; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; few roots along fracture planes; nonporous except in fracture planes; moderately thick clay films on fracture planes and in some pores; neutral (pH_5 6.6); gradual, wavy boundary.

IIC2—36 inches +, disintegrating granite.

The A1 horizon is black or very dark brown when moist and is 10 to 16 inches thick. The B2t horizon may be heavy silt loam, heavy loam, or light clay loam. The solum is 18 to 36 inches thick, and rock occurs at a depth of 20 to 40 inches. In shallow areas quartz particles 1 to 5 millimeters in diameter may constitute as much as 20 percent of the soil mass.

ELOIKA SERIES

The Eloika series is in the Orthod suborder, a division of the Spodosol order. Profile of Eloika silt loam in woodland 100 feet south of gravel pit in SW¼SW¼NE¼ sec. 36, T. 30 N., R. 42 E., W.M., Stevens County, Washington (just over Spokane County line)—

O—2 inches to 0, very dark grayish-brown, loose, partly decomposed organic litter consisting of needles, leaves and twigs; medium acid (pH_5 6.0); abrupt, smooth boundary. 1 to 4 inches thick.

A2—0 to ¼ inch, light-gray (10YR 7/1) very fine sandy loam, gray (10YR 5/1) when dry; massive; loose when dry, nonsticky and nonplastic when wet; slightly acid (pH_5 6.2); abrupt, irregular boundary. ⅛ to 1 inch thick.

B21ir—¼ inch to 3 inches, brown (10YR 5/3) silt loam, dark brown (7.5YR 3/4) when moist; weak, fine, subangular blocky structure; soft when dry, very friable when moist, nonplastic and slightly sticky when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.4); clear, wavy boundary. 1 to 3 inches thick.

B22ir—3 to 14 inches, brown (10YR 5/3) silt loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist, nonplastic and slightly sticky when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.2); gradual, wavy boundary. 8 to 14 inches thick.

B23ir—14 to 24 inches, pale-brown (10YR 6/3) loam, dark brown (7.5YR 4/3) when moist; few, fine, faint mottles; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist, nonplastic and slightly sticky when wet; many very fine pores; abundant roots; slightly acid (pH_5 6.4); clear, wavy boundary. 9 to 14 inches thick.

B3—24 to 44 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 5/3) when moist; common, medium, dark-brown (7.5YR 4/4, moist) mottles; massive; hard when dry, friable when moist, nonsticky and nonplastic when wet; two irregular, wavy, dark-brown loam bands ¼ inch thick; plentiful roots; many very fine pores; slightly acid (pH_5 6.5); clear, wavy boundary. 18 to 24 inches thick.

IIC1—44 to 53 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) when moist; many, medium, dark-brown (7.5YR 4/4, moist) mottles; massive; hard when dry, friable when moist, nonsticky and nonplastic when wet; few roots; common very fine pores; slightly acid (pH_5 6.4).

IIC2—53 to 60 inches +, multicolored grayish-brown and very pale-brown to pale-red subangular and rounded, mostly quartzite and argillite gravel of all sizes, some with coatings that effervesce with dilute HCl; single grain; loose; very few roots; neutral (pH_5 6.7); gravel makes up about 90 percent of this horizon, and sandy loam is interstitial material. The upper few inches has many coarse, dark reddish-brown (5YR 3/4) stains when moist.

The A1 horizon, where present, ranges up to 2 inches in thickness. The A2 horizon is ⅛ to 1 inch thick and has a texture ranging from very fine sandy loam to silt loam. The B2ir horizon is dark brown to dark yellowish brown when moist, and is loam or silt loam. From 5 to 15 percent of the upper part is gravel, and the amount of gravel increases with depth. The amount of gravel and cobblestones in the B3 horizon ranges from 20 to 60 percent. In some places, the lower part of the B2ir horizon is unmottled.

EMDENT SERIES

The Emdent series is in the Aquept suborder, a division of the Inceptisol order. Profile of Emdent silt loam, cultivated, 2,000 feet west of Graham Road in NE¼SW¼ SE¼ sec. 7, T. 24 N., R. 41 E., W.M.—

Ap1—0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, platy structure that breaks to weak, fine and medium, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; strongly alkaline (pH_5 8.8); violently effervescent; abrupt, smooth boundary. 5 to 8 inches thick.

A12—7 to 18 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many fine pores; strongly alkaline (pH_5 8.6); violently effervescent; clear, wavy boundary. 7 to 11 inches thick.

A13—18 to 22 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many fine and common medium pores; strongly alkaline (pH_5 8.5); clear, wavy boundary. 3 to 6 inches thick.

C1—22 to 26 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many fine and common medium pores; thin, continuous coatings in pores; moderately alkaline (pH_5 8.0); abrupt, smooth boundary. 3 to 6 inches thick.

C2—26 to 41 inches, white (10YR 8/2) very fine sandy loam, pale brown (10YR 6/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; few roots; few, fine, distinct, mottles; many fine and common medium pores; thin, patchy coatings in pores; mildly alkaline (pH_5 7.6); abrupt, smooth boundary. 12 to 18 inches thick.

A1b—41 to 47 inches, grayish-brown (10YR 5/2) light silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; few fine and many medium pores; thin, continuous coatings in pores; neutral (pH_5 7.0); abrupt, smooth boundary. 4 to 8 inches thick.

B2b—47 to 60 inches, light brownish-gray (2.5Y 6/2) sandy clay loam, olive gray (5Y 5/2) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; few fine pores; thin, patchy clay films in pores; neutral (pH_5 7.2).

The A1 horizon ranges from black to very dark brown in color, from silt loam to silty clay loam in texture, and from moderately to strongly alkaline in reaction. The C horizon, in some places, contains layers of pumicite or diatomite from 2 to 15 inches thick and thin layers of very fine sandy loam or loam. Mottling ranges from faint to distinct.

FREEMAN SERIES

The Freeman series is representative of the Udalf suborder, a division of the Alfisol order. Following the profile description and the range of characteristics, this series is compared with the Dearyton and Garfield series, which are also in the Udalf suborder.

Profile of Freeman silt loam, cultivated, in SE¼SE¼ sec. 9, T. 23 N., R. 45 E., W.M., 1,080 feet north of SE. section corner and 200 feet west of road—

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; few very fine concretions; neutral (pH_5 6.6); abrupt, smooth boundary. 5 to 8 inches thick.

A21—7 to 12 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; common, fine, vesicular and very fine, tubular pores; occasional, very thin, continuous coatings of clean mineral grains on ped faces; few very fine concretions; neutral (pH_5 6.8); clear, smooth boundary. 2 to 7 inches thick.

A22—12 to 17 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; few roots; common, fine, vesicular pores and very fine, tubular pores; neutral (pH_5 6.8); few very fine concretions; abrupt, smooth boundary. 1 to 7 inches thick.

A&B—17 to 22 inches, pale-brown (10YR 6/3) and light-brown (10YR 7/2) silt loam, dark brown (10YR 4/3) and grayish brown (10YR 5/2) when moist; moderate, medium, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores; ped surfaces are covered with clean mineral grains and discontinuous, moderately thick clay films; moderately thick, continuous clay films in pores; few very fine concretions; neutral (pH_5 6.8); clear, smooth boundary. 3 to 7 inches thick.

B21t—22 to 49 inches, light-brown (7.5YR 6/4) silty clay loam, almost silt loam; dark brown (7.5YR 3/4) when moist; moderate, medium, prismatic structure that breaks to strong, medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores; moderately thick, continuous clay films in pores; common, moderately thick, clay films on ped faces; occasional grayish pocket of silt loam; few very fine concretions; neutral (pH_5 6.8); gradual, smooth boundary. 20 to 30 inches thick.

B22t—49 to 59 inches, light-brown (7.5YR 6/4) silty clay loam, almost silt loam; dark brown (7.5YR 3/4) when moist; strong, medium, prismatic structure that breaks to strong, medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores; grayish-brown (10YR 5/2) coatings on ped faces and on a few, moderately thick clay films; moderately thick clay films in tubular pores; few very fine concretions; neutral (pH_5 6.8); clear, smooth boundary. 8 to 12 inches thick.

B23t—59 to 72 inches, light-brown (7.5YR 6/4) silty clay loam, near silt loam; dark brown (7.5YR 3/4) when moist; strong, medium, prismatic structure that breaks to moderate, medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores; moderately thick clay films on ped surfaces and in tubular

pores; few, thin clay films in interstitial pores; few very fine concretions; neutral (pH_5 6.6).

The color of the A1 horizon, when moist, ranges from very dark grayish brown to dark brown. The A2 horizon is grayish brown to dark brown or is mottled with both colors. This horizon is 4 to 11 inches thick. The texture of the B2t horizon ranges from heavy silt loam to light silty clay loam. Few to common, black to light-brown (dry) concretions are present in the sand fraction. In places small basalt fragments occur throughout the profile.

Laboratory data in the subsection "Chemical and Physical Properties of Soils" show an increase in base saturation, an increase in free iron, and a decrease in acidity with depth. All of these indicate movement of bases and iron from the upper part of the profile. The sharp decrease in clay in the A2 horizon and the increase below the A2 indicate that clay has been removed from the A2 and deposited below. Clay films in all horizons below the A2 are evidence of this. No doubt some clay has formed in place in the B2t horizons. The percentage of clay is high to a depth of 72 inches, which leads to the conclusion that the Freeman soils, like the Nez Perce and Reardan, formed in parent material that was deposited in layers over long periods and that the material in the lower layers is very old. The carbon-nitrogen ratio in the profile described is rather narrow, about 15, because the sample was taken in a cultivated field. Undoubtedly the ratio is much wider, probably about 25, in virgin areas. The strong structure in the B horizon indicates that the soil material shrinks and swells appreciably with change in moisture content. Stripping of colloidal material by percolating water accounts for the clean mineral grains on ped surfaces in the A and B horizons.

The Dearyton soils are similar to the Freeman soils in horizonation and evidence of soil development.

Garfield soils lack an A2 horizon. They formed under grass vegetation, and at one time the surface layer was thick enough for these soils to be placed in the Mollisol order; but erosion has thinned the surface layer to such an extent that they now are classified as Alfisols.

GARFIELD SERIES

The Garfield series is in the Udalf suborder, a division of the Alfisol order. Profile of Garfield silty clay loam, cultivated, 2.1 miles west of junction of old Palouse Highway and Spangle Waverly Road at a point 50 feet south of Spangle Waverly Road, in SE¼SE¼NW¼ sec. 32, T. 22 N., R. 44 E., W. M.—

Ap1—0 to ½ inch, mixed dark grayish-brown (10YR 4/2) and brown (7.5YR 5/4) silty clay loam, very dark brown (10YR 2/2), and dark brown (7.5YR 3/4) when moist; strong, very fine, granular structure; loose when dry, friable when moist, sticky and plastic when wet; abundant roots; neutral (pH_5 6.6); abrupt, smooth boundary. 0 to 1 inch thick.

Ap2—½ inch to 8 inches, predominantly dark grayish-brown (10YR 4/2) silty clay loam, with some brown (7.5YR 5/4), very dark grayish brown (10YR 3/2), and dark brown (7.5YR 4/3) when moist; strong, very fine and fine, granular structure; very hard when dry, firm when moist, sticky and plastic when wet; abundant roots; many very fine pores; thin, nearly continuous clay films on dark-brown peds; neutral (pH_5 6.6); abrupt, smooth boundary. 7 to 11 inches thick.

B2t—8 to 23 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that breaks to strong, fine, angular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; plentiful roots; many very fine tubular pores; thin, continuous clay films on ped faces, interstitial pores filled with colloid; common, fine (1 to 2 mm.), black concretions; few, clean, mineral grains on ped faces; neutral (pH_5 6.8); clear, wavy boundary. 10 to 40 inches thick.

B31t—23 to 29 inches, light yellowish-brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) when moist; moderate, medium, prismatic structure that breaks to moderate, fine and medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many, very fine, tubular and interstitial pores; thin and moderately thick, nearly continuous clay films on ped faces and in pores; common clean mineral grains on ped faces; few, very fine (less than 1 mm.), black concretions; peds disintegrate in water; neutral (pH_5 6.8); clear, wavy boundary. 4 to 8 inches thick.

B32t—29 to 48 inches, light yellowish-brown (10YR 6/5) light silty clay loam, yellowish brown (10YR 5/4) when moist; moderate, fine and medium, prismatic structure that breaks to strong, very fine and fine, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; few roots; many, very fine, tubular and interstitial pores; common, thin and moderately thick, continuous clay films on ped faces and in tubular pores (7.5YR hue); few, fine (1 to 2 mm.), black concretions; many, patchy, black stains on peds; dried peds soften but remain stable in water and are slightly brittle when moist; neutral (pH_5 7.2); gradual, wavy boundary. 12 to 30 inches thick.

B33t—48 to 60 inches +, light yellowish-brown (10YR 6/4) heavy silt loam, yellowish brown (10YR 5/4) when moist; moderate, medium, prismatic structure that breaks to moderate, fine and medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common, very fine, tubular and many, very fine, interstitial pores; moderately thick, continuous clay films on some ped faces and in tubular pores; few, fine, black concretions; common black stains on ped faces; peds are stable in water but are softer than in the horizon above; neutral (pH_5 7.2).

The color of the A horizon when moist may be dark brown, very dark grayish brown, brown, or very dark brown. In places, the soil grades to a massive silt loam C1 horizon at a depth of about 4 feet. The B32t horizon has the characteristics of a weakly developed fragipan.

GARRISON SERIES

The Garrison series is in the Xeroll suborder, a division of the Mollisol order. Profile of Garrison gravelly loam, cultivated, 50 feet north of Mission Avenue and 346 feet west of its intersection with Molter Road in SE¼SE¼SW¼ sec. 10, T. 25 N., R. 45 E., W.M.—

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) gravelly loam, black (10YR 2/1) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; porous; slightly acid (pH_5 6.2); abrupt, smooth boundary. 6 to 10 inches thick.

A1—6 to 15 inches, similar to above, but granules are fine and medium and the acidity is pH_5 6.4; clear, wavy boundary. 9 to 13 inches thick.

B1—15 to 27 inches, dark grayish-brown (10YR 4/2) very gravelly loam, dark brown (10YR 3/3) when moist; massive or weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; porous; neutral (pH_5 6.7); clear, wavy boundary. 9 to 16 inches thick.

B2—27 to 35 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) when moist; massive or weak, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; porous; neutral (pH_5 6.8); clear, wavy boundary. 6 to 12 inches thick.

C1—35 to 44 inches, pale-brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) when moist; massive; hard when dry, friable when moist, slightly sticky and nonplastic when wet; plentiful roots; very porous; neutral (pH_5 7.2); gradual, wavy boundary. 6 to 12 inches thick.

C2—44 to 60 inches +, multicolored granite and quartz sand, gravel and cobblestones.

The A horizon, when moist, ranges from black to very dark brown in color. The texture may be gravelly fine sandy loam, gravelly loam, or gravelly silt loam. In places, from 20 to 60 percent of the A horizon consists of cobblestones or stones. The amount of gravel or cobblestones in the B horizon ranges from 40 to 70 percent. The color of the B2 horizon ranges from dark brown to dark yellowish brown. Sand, gravel, and cobblestones generally occur at a depth of 30 to 55 inches.

GLENROSE SERIES

The Glenrose series is in the Xeroll suborder, a division of the Mollisol order. Profile of Glenrose silt loam, cultivated, 50 feet east of Big Rock in NW¼NW¼NE¼ sec. 24, T. 24 N., R. 43 E., W.M.—

Ap—0 to 6 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, platy structure and fine granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.8); clear, smooth boundary. 4 to 8 inches thick.

A1—6 to 13 inches, dark grayish-brown (10YR 4/2) silt loam, black (10YR 2/1) when moist; weak, medium, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; neutral (pH_5 6.8); clear, wavy boundary. 6 to 12 inches thick.

B1t—13 to 24 inches, pale-brown (10YR 6/3) silt loam, near loam; dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure; slightly hard to hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; few, very thin clay films in pores; neutral (pH_5 6.7); gradual, wavy boundary. 9 to 14 inches thick.

IIB2t—24 to 41 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; thin, nearly continuous, clay films in pores; common, clean mineral grains on fracture planes; neutral (pH_5 6.6); gradual, wavy boundary. 8 to 13 inches thick.

IIB3t—41 to 62 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; many very fine pores; few thin clay films in pores; occasional gravel; slightly acid (pH_5 6.5); gradual, wavy boundary. 20 to 30 inches thick.

IIC1—62 to 72 inches +, brown (10YR 5/3) loam, dark brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; no roots; many very fine pores; slightly acid (pH_5 6.5).

The A1 horizon ranges from black to very dark brown when moist and from 10 to 16 inches in thickness. In places it is gravelly or stony. The texture of the B horizon ranges from silt loam or loam to light silty clay loam. Thin, nearly continuous or continuous clay films are present in the B horizon, mainly in tubular and interstitial pores. From 5 to 25 percent of the lower B horizon may consist of gravel and stones.

GREEN BLUFF SERIES

The Green Bluff series is in the Ochrept suborder, a division of the Inceptisol order. Profile of Green Bluff silt loam, cultivated, 150 feet south of the northeast corner of section 20 and 60 feet west of the center of Sands Road in NE¼NE¼ sec. 20, T. 27 N., R. 44 E., W.M.—

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; slightly acid (pH_5 6.4); abrupt, wavy boundary. 4 to 8 inches thick.

B1—7 to 19 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; few, medium, dark-brown (7.5YR 4/4 moist) mottles; one irregular, wavy, dark-brown band 1 inch thick; slightly acid (pH_5 6.4); gradual, wavy boundary. 8 to 12 inches thick.

B2—19 to 33 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, prismatic structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; common, medium, dark-brown (7.5YR 4/4 moist) mottles; one dark-brown, irregular, wavy band about 1 inch thick; neutral (pH_5 6.6); gradual, wavy boundary. 12 to 30 inches thick.

C1—33 to 40 inches, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; common, medium, dark-brown (7.5YR 4/4 moist) mottles; slightly acid (pH_5 6.5); clear, wavy boundary. 6 to 12 inches thick.

C2—40 to 50 inches, very pale brown (10YR 7/3) gravelly silt loam, brown (10YR 5/3) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; common, medium, dark-brown (7.5YR 4/4 moist) mottles; slightly acid (pH_5 6.5); gradual, wavy boundary. 8 to 12 inches thick.

C3—50 to 62 inches +, pale-yellow (2.5YR 7/4) gravelly silt loam, olive brown (2.5YR 4/4) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many fine pores; common, medium, dark-brown (7.5YR 4/4 moist) mottles; slightly acid (pH_5 6.5). 10 to 20 inches thick.

The A horizon, when moist, is dark brown to very dark grayish brown. The texture of the B horizon is silt loam or loam. Thin, discontinuous clay films are present in places. Mottling of the B2 horizon ranges from faint to distinct. In places this soil overlies laminated lake sediments at a depth less than 5 feet. As much as 60 percent of the lower C horizon may consist of gravel, cobblestones, and stones.

HAGEN SERIES

The Hagen series is in the Orthod suborder, a division of the Spodosol order. Profile of Hagen sandy loam in woodland 200 feet west and 2,100 feet north of junction of Cedar Road and West Morland Road, in NE¼NE¼ sec. 12, T. 28 N., R. 42 E., W.M.—

O—1½ inches to 0, very dark grayish-brown (10YR 3/2), loose, partly decomposed organic litter of needles, leaves, and twigs; (pH_5 5.9).

A1—0 to 1 inch, light brownish-gray (10YR 6/2) sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; few, weak, fine, black aggregates; slightly acid (pH_5 6.2); clear, smooth boundary. 1 to 4 inches thick.

B21ir—1 to 4 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, medium, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; few, very fine, black aggregates; slightly acid (pH_5 6.2); clear, smooth boundary. 3 to 6 inches thick.

B22ir—4 to 11 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/4) when moist; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; few, very fine, black aggregates; neutral (pH_5 6.6); gradual, smooth lower boundary. 5 to 8 inches thick.

C1—11 to 24 inches, very pale-brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; few, very fine, black aggregates; slightly acid (pH_5 6.4); gradual, wavy boundry. 11 to 15 inches thick.

C2—24 to 38 inches, pale-brown (10YR 6/3) loamy sand, olive brown (2.5YR 4/4) when moist; massive; loose when dry, nonsticky and nonplastic when wet; plentiful roots; porous; contains two discontinuous bands, each 1/8 to 1/4 inch thick, of loam texture and dark brown color; neutral (pH_5 6.9); gradual, wavy boundary. 14 to 20 inches thick.

C3—38 to 120 inches, pale-brown but somewhat variegated medium-textured sand; single grain; loose when dry, nonsticky and nonplastic when wet; few roots; porous; contains bands of dark brown color but of no textural difference from matrix; neutral (pH_5 7.0).

The A horizon ranges from 1 to 4 inches in thickness, and the color is very dark brown to brown when moist. An A2 horizon as much as 1/4 inch thick is present in places. The thin, discontinuous bands in the C horizon may have a loam texture or just a contrasting dark-brown color. The bands are thinner in the lower C horizon.

HARDESTY SERIES

The Hardesty series is the only series in Spokane County that is in the Andept suborder, a division of the Inceptisol order. Profile of Hardesty silt loam in woodland 76 feet south of lane to gravel pit, approximately 300 yards north of the center of sec. 35, T. 25 N., R. 44 E., W.M.—

Ap—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, platy structure that breaks to moderate, medium, granular; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; slightly acid (pH_5 6.4); abrupt, smooth boundary.

A12—4 to 11 inches, brown (10YR 5/2) silt loam, dark brown (10YR 3/3) when moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; few very fine pores; slightly acid (pH_5 6.4); clear, smooth boundary. 5 to 10 inches thick.

C1—11 to 23 inches, pale-brown (10YR 6/3) light silt loam, dark brown (10YR 4/3) when moist; massive; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and few fine pores; neutral (pH_5 6.6); clear, wavy boundary. 12 to 18 inches thick.

C2—23 to 32 inches, very pale brown (10YR 7/3) light silt loam, brown (10YR 5/3) when moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and fine pores; common, medium, distinct, dark-brown (7.5YR 4/4, moist) mottles; neutral (pH_5 6.8); abrupt, wavy boundary. Variable thickness.

C3—32 to 39 inches, very pale-brown (10YR 7/4) very fine sandy loam, yellowish brown (10YR 5/4) when moist; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; few very fine pores; few, medium, distinct, dark-brown (7.5YR 4/4, moist) mottles; neutral (pH_5 6.8); abrupt, wavy boundary. Variable thickness.

C4—39 to 60 inches, very pale-brown (10YR 8/3) loamy very fine sand, pale brown (10YR 6/3) when moist; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; few roots; few fine pores; coarsely laminated with thin, wavy, dark-brown (7.5YR 4/4, moist) bands; neutral (pH_5 6.8).

In undisturbed areas of this soil, a thin O horizon is present. The A horizon is very dark brown or dark grayish brown when moist and is 8 to 16 inches thick. The texture of the C horizon ranges from loamy very fine sand to silt loam. The mottles in this horizon range from few, fine, and faint to common, medium, and distinct. In places the soil overlies sand, gravel, or basalt at a moderate depth.

The accumulation of organic matter accounts for the dark color of the Ap and A12 horizons and the granular structure of the Ap. Some bases have been leached, as indicated by the slightly acid reaction of the Ap and A12. The mottles in the C2 and C3 horizons reflect the somewhat impeded drainage. The bands in the C4 horizon are the result of deposition of iron oxides and clay. Hardesty soils are light in weight (have a low bulk density) because their parent material was volcanic ash, which is light in weight.

HESSELTINE SERIES

The Hesseltine series is in the Xeroll surborder, a division of the Mollisol order. Profile of Hesseltine silt loam in woodland 75 feet south of Cornwall Road between two blazed pine trees in the NE1/4NW1/4 sec. 32, T. 23 N., R. 40 E., W.M.—

O—1/2 inch to 0, very dark grayish-brown, partly decomposed litter composed of pine needles, leaves, twigs, and cones; medium acid (pH_5 5.8); abrupt, smooth boundary.

A1—0 to 3 inches, brown (10YR 5/3) silt loam, dark brown (7.5YR 3/2) when moist; weak, medium, platy structure that breaks to moderate, fine, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; slightly acid (pH_5 6.5); clear, smooth boundary. 3 to 8 inches thick.

A3—3 to 6 inches, brown (10YR 5/3) silt loam, dark brown (7.5YR 3/3) when moist; weak, medium, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; neutral (pH_5 6.7); clear, smooth boundary. 2 to 6 inches thick.

B21t—6 to 13 inches, brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/3) when moist; moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; abundant roots; many very fine pores and few fine and medium pores; common, thin, clay films on ped faces and in pores; neutral (pH_5 6.7); clear, wavy boundary. 6 to 12 inches thick.

B22t—13 to 17 inches, brown (7.5YR 5/4) gravelly loam near silt loam, dark brown (7.5YR 4/3) when moist; moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; abundant roots; many very fine pores; common thin clay films on peds and in pores; few clean mineral grains on ped surfaces; neutral (pH_5 6.8); abrupt, wavy boundary. 3 to 8 inches thick.

IIC1—17 to 36 inches, multicolored reddish-brown to olive-brown very gravelly, cobbly, and stony coarse sandy

loam; single grain; loose; gravel, cobblestones, and stones thinly coated with fines (10YR 5/4 to 3/3); few roots; very porus; neutral (pH_5 7.0); gradual, wavy boundary.

IIIC2—36 to 60 inches, similar to above but contains little or no fine material; a few roots enter the top few inches.

The A1 horizon ranges from very dark grayish brown to dark brown (10YR or 7.5YR hue) when moist. In places it is gravelly or cobbly. The B2t horizon is gravelly loam or gravelly silt loam and has thin, discontinuous or continuous clay films on ped faces and in pores. It contains more clay than the A1 horizon. The hue is 7.5YR or 5YR. The depth to gravel and cobblestones ranges from 12 to 36 inches.

KONNER SERIES

The Konner series is in the Aquoll suborder, a division of the Mollisol order. Profile of Konner silty clay loam, cultivated, 2,640 feet south and 250 feet west of the junction of Scribner Road and Forker Road in SE¼NE¼ sec. 2, T. 26 N., R 44 E., W.M.—

Ap—0 to 7 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; moderate, fine, granular structure; slightly hard when dry, friable when moist, sticky and plastic when wet; plentiful roots; neutral (pH_5 6.6); abrupt, smooth boundary. 5 to 8 inches thick.

A1–7 to 11 inches, dark-gray (10YR 4/1) heavy silty clay loam, black (10YR 2/1) when moist; moderate, fine, granular structure; slightly hard when dry, friable when moist, sticky and plastic when wet; plentiful roots; porous; neutral (pH_5 6.6); abrupt, smooth boundary. 5 to 8 inches thick.

A3g—11 to 27 inches, grayish-brown (10YR 5/2) silty clay loam with thin gray (10YR 5/1) coating, very dark grayish brown (10YR 3/2) with very dark gray (10YR 3/1) coating when moist; strong, medium, prismatic structure that breaks to very fine, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; many very fine pores; common thin coatings in pores and on some ped faces; few, very fine, black stains in pores; neutral (pH_5 6.8); clear, smooth boundary. 14 to 18 inches thick.

B21tg—27 to 40 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; strong, fine, prismatic structure that breaks to strong, fine, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores and common fine pores; common, thin and moderately thick, slightly darker colored clay films on ped surfaces; continuous clay films in tubular pores and in some adjacent interstitial pores; few, fine, faint mottles; neutral (pH_5 6.8); clear, wavy boundary. 10 to 16 inches thick.

IIB22tg—40 to 55 inches, grayish-brown (10YR 5/2) clay loam, near sandy clay loam; dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that breaks to weak, medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common fine pores and many very fine pores; clay films as above but fewer; few, fine, faint mottles; neutral (pH_5 6.8); abrupt, wavy boundary. 12 to 20 inches thick.

IIC3—55 to 60 inches, light brownish-gray (10YR 6/2) sandy clay loam, dark grayish brown (10YR 4/2) when moist; massive; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine and fine pores; few thin clay films in pores; few, fine, faint mottles; neutral (pH_5 7.2).

The A1 horizon is black or very dark gray (10YR hue) when moist and is silty clay loam or silt loam. The A3g and B21tg horizons are grayish brown with thin gray (10YR 5/1) coatings. The B2t horizon is micaceous silty clay loam or clay loam. This horizon has few to common, thin or moderately thick clay films on structure faces and nearly continuous or continuous clay films in tubular pores. In some places layers of pumicite or diatomite and thin lenses of sand and gravel are present in the lower solum.

LAKESOL SERIES

The Lakesol series is in the Xeroll suborder, a division of the Mollisol order. Profile of Lakesol silt loam, cultivated, 1,320 feet south of center of sec. 21, T. 27 N., R. 43 E., W.M. and 20 feet east of Little Spokane Drive—

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 7.0); abrupt, smooth boundary. 4 to 8 inches thick.

A1—6 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that breaks to weak, fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.8); abrupt, smooth boundary. 2 to 4 inches thick.

B21—9 to 13 inches, light brownish-gray silt loam with common, medium, light yellowish-brown coating (10YR 6/2 and 6/4), dark brownish gray and yellowish brown (10YR 4/2 and 5/4) when moist; weak, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.6); clear, wavy boundary. 3 to 6 inches thick.

B22—13 to 20 inches, light-gray (10YR 7/2) coarse silt loam with common, medium, reddish-yellow (7.5YR 6/6) nodules and stains, dark brown (10YR 4/3) and yellowish red (5YR 5/6) when moist; weak, medium, prismatic structure; in places coarsely laminated; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many, very fine, tubular pores.

C1—20 to 65 inches, mottled light-gray and pale-yellow (2.5Y 7/2 and 7/4) coarse silt loam, light brownish gray and reddish yellow (2.5Y 5/2 and 7.5YR 6/6) when moist; coarsely laminated sediments; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; few medium pores; some darker colored stains on vertical fracture planes; neutral (pH_5 6.6).

The color of the A horizon is very dark brown to very dark grayish brown when moist, and the structure is moderate, fine, granular or weak, fine, platy. The structure of the B horizon is weak or moderate, medium, prismatic. The hue of the C horizon is 2.5Y, 10YR, or 7.5YR. In some places there is a stone line immediately above the lake sediments. The lake sediments are at a depth of 10 to 30 inches and include laminations of silt, very fine sand, silt loam, and silty clay loam.

LAKETON SERIES

The Laketon series is in the Ochrept suborder, a division of the Inceptisol order. Profile of Laketon silt loam, cultivated, 75 feet north and 90 feet west of junction of Chet Conner farm road and Grove Road in sec. 4, T. 29 N., R. 42 E., W.M.—

Ap—0 to 10 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.8); abrupt, smooth boundary. 6 to 11 inches thick.

B2—10 to 16 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common very fine and fine pores; few, fine, strong-brown (7.5YR 5/6) mottles; neutral (pH_5 6.8); clear, wavy boundary. 4 to 10 inches thick.

C—16 to 24 inches, very pale-brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, coarse, prismatic structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine and fine pores; few, fine, dark-brown (7.5YR 4/4), distinct mottles; neutral (pH_5 6.6); clear, wavy boundary. 6 to 10 inches thick.

IIA2b—24 to 32 inches, light-gray (2.5Y 7/2) silt loam, brown (10YR 5/3) when moist; weak, medium, prismatic structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; few, fine, distinct, dark-brown (7.5YR 4/4) mottles; most mineral grains are unstained; neutral (pH_5 6.6); clear, smooth boundary. 6 to 10 inches thick.

IIB2tb—32 to 60 inches, light-gray (2.5Y 7/2) light silty clay loam, brown (10YR 5/3) when moist; moderate, medium, prismatic structure; very hard when dry, very firm when moist, slightly sticky and plastic when wet; few roots; many very fine pores, some appear to be vesicular; many, medium, dark-brown (7.5YR 4/4) mottles; common, thin and moderately thick clay films on ped faces and in pores; slightly acid (pH_5 6.4).

Uncultivated sites have a thin O horizon and a grayish-brown A1 horizon 2 to 4 inches thick. In places the A horizon is fine sandy loam. The B2 horizon is silt loam to very fine sandy loam and, when moist, is dark brown to yellowish brown. The IIB2bt horizon is at a depth of 2 to 3 feet and may be heavy silt loam, silty clay loam, or clay loam. Gravel is scattered throughout the profile.

LANCE SERIES

The Lance series is in the Orthent suborder, a division of the Entisol order. Following the profile description and the range of characteristics below, this series is compared with the Wethey series, which is also in the Orthent suborder.

Profile of Lance silt loam, cultivated, 660 feet southwest of the northwest corner and 960 feet northwest of the southwest corner of the Fairview Cemetery in sec. 14, T. 23 N., R. 41 E., W.M.—

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; violent effervescence; moderately alkaline (pH_5 8.4); abrupt, smooth boundary. 6 to 12 inches thick.

C1—9 to 14 inches, white (10YR 8/2) and light-gray (10YR 7/2) silt loam, white (10YR 8/2) and brown (10YR 5/3) when moist; strong, medium and coarse, platy structure; few, lime-silica, cemented aggregates and lenses that are extremely hard and brittle; very hard when dry, very firm when moist, slightly sticky and slightly plastic when wet; few roots; common very fine pores; violent effervescence, lime continuous on laminations and as threads in matrix; strongly alkaline (pH_5 8.6); clear, wavy boundary. 3 to 8 inches thick.

C2ca—14 to 22 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; common very fine pores; common black (10YR 2/1) manganese coating on peds; few thin clay films on peds; strongly effervescent, lime mainly present in seams and in pores; common gravel-size aggregates that are cemented with lime and silica and are extremely hard and brittle; some inner peds essentially noneffervescent; strongly alkaline (pH_5 8.6); clear, wavy boundary. 6 to 8 inches thick.

B2tb—22 to 40 inches, light-brown (7.5YR 6/4) silty clay loam, dark brown (7.5YR 4/4) when moist; moderate, fine and medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine pores; common, black (10YR 2/1), manganese coatings on peds; thin, discontinuous clay films on peds and in pores; lime in seams and in pores but matrix noneffervescent; strongly alkaline (pH_5 8.6); clear, wavy boundary. 12 to 24 inches thick.

B3b—40 to 60 inches +, light yellowish-brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) when moist; massive (structureless); hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; few very fine pores; few thin clay films in tubular pores and on fractured pores; slightly effervescent, lime in seams and in pores; moderately alkaline (pH_5 8.2).

Where the soil is uneroded, the A horizon may be very dark brown when moist and may be noneffervescent in the upper part. Most areas are cultivated, and as much as 15 percent of the Ap horizon consists of small fragments cemented with lime and silica. The C horizon in places contains sporadic layers of thin plates that are weakly or strongly cemented with lime and silica. In other places the cemented layers may be several inches thick. The depth to the buried soil varies; in places the buried soil is not above a depth of 5 feet.

Lance soils formed in strongly calcareous, light-colored parent material. The principal evidences of soil development are a darkening in the color of the top 9 inches and a weak granular structure in that part, both caused by the accumulation of organic matter. In uneroded areas, lime has been removed from the top few inches by leaching, and the A horizon is noncalcareous. At the location of the profile described and in many places elsewhere, the material in which the Lance soils formed was deposited over an older soil.

Wethey soils occupy mostly concave positions subject to seepage and nearly level areas along streams. These soils are somewhat poorly drained or poorly drained. The mottles within 2 feet of the surface are the only evidence of soil development. These mottles formed because of a deficiency of oxygen during periods when the soil was saturated. Organisms living in the soil obtain some of their oxygen from iron compounds which, along with organic matter, are the main coloring agents in soils. With the loss of oxygen the iron compounds in the Wethey soils changed in color from reddish or yellowish to gray or green and became soluble. Some of the soluble iron was removed in drainage water. When the soil dried out periodically as the water table dropped, the iron became reoxidized and segregated, and the bright-colored mottles formed.

LARKIN SERIES

The Larkin series is in the Xeroll suborder, a division of the Mollisol order. Profile of Larkin silt loam, cultivated, 740 feet south and 75 feet east of junction of Jackson Road and Rockford-Mount Hope Road in NE¼SW¼ sec. 36, T. 23 N., R. 44 E., W.M.—

Ap1—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak,

fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; slightly acid (pH_5 6.4); abrupt, smooth boundary. 6 to 10 inches thick.

A12—8 to 13 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many fine pores; neutral (pH_5 6.6); clear, wavy boundary. 2 to 6 inches thick.

B1t—13 to 24 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure; hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; many fine pores; thin, patchy clay films and few, thin siliceous coatings on peds; neutral (pH_5 6.8); gradual, wavy boundary. 8 to 15 inches thick.

B21t—24 to 40 inches, pale-brown (10YR 6/3) heavy silt loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; many fine pores; thin, continuous clay films and thin siliceous coatings on peds; two thin, irregular, wavy, dark-brown (7.5YR 4/4) bands; neutral (pH_5 6.8); clear, wavy boundary. 12 to 20 inches thick.

B22t—40 to 56 inches, pale-brown (10YR 6/3) heavy silt loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; many fine pores, thin, continuous clay films and thin, patchy siliceous coatings on peds; one thin, irregular, wavy, dark-brown (7.5YR 4/4) band; neutral (pH_5 6.8); gradual, wavy boundary. 12 to 22 inches thick.

C—56 to 72 inches +, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; many fine pores; thin, patchy, discontinuous clay films on peds; neutral (pH_5 6.8).

The A1 horizon is very dark grayish brown to dark brown. Silica coatings in the B horizon range from a few bleached particles to continuous, thin coatings on all ped faces.

LATAH SERIES

The Latah series is in the Alboll suborder, a division of the Mollisol order. Profile of Latah silt loam, cultivated, 2,640 feet north and 50 feet east of Bridge No. 5107 on Knight Road in SW¼NE¼ sec. 28, T. 21 N., R. 45 E., W.M.—

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine and medium, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; slightly acid (pH_5 6.4); abrupt, smooth boundary. 6 to 11 inches thick.

A11—8 to 23 inches, dark-gray (10YR 4/1) silty clay loam with a few, fine, strong-brown (7.5YR 5/6) mottles, black (10YR 2/1) when moist; moderate, medium, prismatic structure that breaks to strong, fine and medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; abundant roots; common, fine, medium and large pores; peds coated with clean grains of silt and very fine sand; slightly acid (pH_5 6.4); gradual, wavy boundary. 12 to 20 inches thick.

A12—23 to 32 inches, gray (10YR 5/1) silty clay loam with a few, fine, strong-brown (7.5YR 5/6) mottles, very dark gray (10YR 3/1) when moist; moderate, medium and coarse, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; abundant roots; many very fine pores; peds coated with clean mineral grains; neutral (pH_5 6.6); abrupt, smooth boundary. 6 to 14 inches thick.

A2g—32 to 38 inches, gray (10YR 6/1) heavy silt loam with a few strong-brown (7.5YR 5/6) mottles, dark gray (10-YR 4/1) when moist; massive; hard when dry, very friable when moist, slightly sticky and plastic when wet; few roots; many fine and medium pores; peds nearly continuously coated with clean mineral grains; neutral (pH_5 6.6); abrupt, smooth boundary. 5 to 12 inches thick.

B21tg—38 to 45 inches, gray (10YR 6/1) silty clay with a few, fine, strong-brown (7.5YR 5/6) mottles, very dark gray (10YR 3/1) when moist; strong, coarse, columnar structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine pores; thin, continuous clay films on ped faces and in pores with clean mineral grains on surfaces; neutral (pH_5 6.8); clear, wavy boundary. 6 to 11 inches thick.

B22tg—45 to 58 inches, gray (10YR 5/1) silty clay loam with a few, fine, strong-brown (7.5YR 5/6) mottles, very dark gray (N 3/0) when moist; moderate, coarse, prismatic structure that breaks to moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine pores; common thin clay films on peds and continuous, thin clay films in pores; common clean mineral grains on ped surfaces and in most pores except where mottled; neutral (pH_5 6.8); abrupt, smooth boundary. 10 to 19 inches thick.

B3g—58 to 60 inches +, gray (5Y 6/1) silty clay loam with a few, fine, strong-brown (7.5YR 5/6) mottles, very dark gray (5Y 3/1) when moist; weak, coarse, prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine and fine pores; prisms and clods have clean mineral grains on surfaces, although small areas have iron-stained grains; few thin clay films present on ped faces; neutral (pH_5 7.0).

The A1 horizon ranges from very dark gray to black in color and from silt loam to silty clay loam in texture. The B2 ranges from silty clay loam to silty clay. The reaction is slightly acid to moderately alkaline.

MARBLE SERIES

The Marble series is the only series in Spokane County that is in the Psamment suborder, a division of the Entisol order. Profile of Marble loamy sand in woodland 1.1 mile east of the junction of Newport Highway and the Day-Mount Spokane Road, and 50 feet north of this road in the SE¼SE¼ sec. 26, T. 27 N., R. 43 E., W.M.—

O—1 inch to 0, very dark grayish-brown, loose, partly decomposed organic litter composed of needles, leaves, and twigs.

A1—0 to 3 inches, grayish-brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; porous; slightly acid (pH_5 6.4); clear, smooth boundary. 2 to 6 inches thick.

C1—3 to 6 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; porous; slightly acid (pH_5 6.4); clear, wavy boundary. 2 to 10 inches thick.

C2—6 to 47 inches, light brownish-gray (10YR 6/2) coarse sand, light olive brown (2.5Y 5/4) when moist; single grain; loose when dry and when moist; plentiful roots; few, irregular, wavy, dark-brown bands ⅛ to ¼ inch thick; neutral (pH_5 6.6); gradual, wavy boundary. 36 to 48 inches thick.

C3—47 to 60 inches +, multicolored coarse sand; single grain; loose; few roots; neutral (pH_5 7.0).

The A1 horizon may be very dark grayish brown or very dark brown when moist, and the texture ranges from loamy coarse sand to sandy loam. The control section is dominantly loamy coarse sand or sand, but in places much of

it is coarse sandy loam. The thin, discontinuous, dark-brown bands in the lower part of the C horizon are absent in some places, but where they are present their texture may be sandy loam.

The principal evidences of soil development are the slight darkening of the upper 6 inches and the weak granular structure in the upper 3 inches, both of which result from the accumulation of organic matter; a slight increase in acidity in the upper part of the soil caused by leaching of bases; and the few irregular, wavy bands in the C2 horizon caused by deposition of iron and clay. Presumably, these bands formed as iron oxides were precipitated from soluble, organic chelates down to layers where the acidity decreased. Clay carried downward in the soil solution was flocculated when it came in contact with the iron, thus forming bands that contain much iron and clay.

The bands in the Marble soils are much like those in the Clayton soils. A sample from a band in a Clayton soil contained 12.8 percent clay and 1.5 percent free iron, compared to 2.5 percent clay and 0.8 percent free iron in the layer above it. This is shown in the laboratory data in the subsection "Chemical and Physical Properties of Soils."

MONDOVI SERIES

The Mondovi series is in the Ustoll suborder, a division of the Mollisol order. Profile of Mondovi silt loam, cultivated, 1,190 feet east and 90 feet south of E¼ corner, sec. 20, T. 26 N., R. 40 E., W.M.—

Ap1—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.8); abrupt, smooth boundary. 6 to 9 inches thick.

Ap2—8 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; neutral (pH_5 7.0); clear, smooth boundary. 6 to 9 inches thick.

C—15 to 60 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; neutral (pH_5 7.0).

The upper A horizon, when moist, ranges in color from very dark brown to nearly black. Alternating layers of black, very dark brown, very dark grayish-brown, or dark-brown soil commonly occur in the C horizon. Gravel and cobblestones are in the profile in some places.

MOSCOW SERIES

The Moscow series is in the Orthod suborder, a division of the Spodosol order. Profile of Moscow silt loam in woodland in SW¼SE¼ of sec. 21, T. 29 N., R. 45 E.—

O—1 inch to 0, fir needles, twigs, and leaves.

A2—0 to ½ inch, light-gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; porous; medium acid (pH_5 5.8); abrupt, broken boundary. 0 to ½ inch thick.

B2ir—½ inch to 13 inches, pale-brown (10YR 6/3) silt loam, nearly loam; dark brown (7.5YR 4/3) when moist; weak, very fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine tubular pores; organic matter appears to be present in very fine aggregates; medium acid (pH_5 5.8); gradual, wavy boundary. 4 to 8 inches thick.

IIB3—13 to 27 inches, light yellowish-brown (10YR 6/4) loam, yellowish brown (10YR 5/4) when moist; essentially massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; some tonguing of the B horizon; about 10 percent gravel; strongly acid (pH_5 5.3); clear, wavy boundary. 10 to 25 inches thick.

IIC1—27 inches +, variegated white, light-gray, very pale-brown, and brown (10YR 8/2, 6/1, and 7/4 and 7.5YR 5/4) decomposing granite with large crystals of mica; massive but breaks or crumbles readily to gravel and coarse sand; very hard when dry, very firm when moist; very few roots; few very fine pores; rock structure still clearly visible; few moderately thick clay films in pores; strongly acid (pH_5 5.1). Variable thickness to hard granite.

The depth to hard granite exceeds 20 inches. Mixed loess and weathered granite occur at a shallow or very shallow depth.

NAFF SERIES

The Naff series is in the Xeroll suborder, a division of the Mollisol order. Profile of Naff silt loam, cultivated, 800 feet south of the northeast corner of sec. 2, T. 21 N., R. 45 E., and 75 feet west of center of Latah cutoff road—

Ap1—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, coarse, platy structure that breaks to moderate, fine granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; neutral (pH_5 6.6); abrupt, smooth boundary. 6 to 10 inches thick.

A12—8 to 17 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, coarse, prismatic structure that breaks to moderate, fine, granular structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; many very fine pores; slightly acid (pH_5 6.4); clear, wavy boundary. 5 to 10 inches thick.

B1t—17 to 26 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 3/3) when moist; moderate, fine, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; many very fine pores; peds and pores coated with clean grains of very fine sand and silt; a few thin clay films visible below coatings on peds; neutral (pH_5 6.6); gradual, wavy boundary. 8 to 20 inches thick.

B21t—26 to 61 inches, pale-brown (10YR 6/3) light silty clay loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, angular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; many fine roots; many very fine pores; thin clay films on blocks and in some pores; coating of clean silt or very fine sand on prism faces; few black stains and very fine concretions; neutral (pH_5 6.8); gradual, wavy boundary. 25 to 40 inches thick.

B22t—61 to 80 inches, pale-brown (10YR 6/3) light silty clay loam, brown (10YR 5/3) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores; thin, continuous clay films on ped faces and in pores; common black stains and very fine concretions; neutral (pH_5 6.8). 20 to 30 inches thick.

The A1 horizon ranges from very dark brown to nearly black in color when moist and from 12 to 18 inches in thickness. The Bt horizon ranges from brown to dark yellowish brown in color when moist and from silty clay loam to silty clay in texture. The B horizon appears to have had

the clay films almost entirely stripped from the upper part, although in places discontinuous clay films can be seen. The peds in the upper B horizon have a coating of clean very fine sand and silt grains that range in amount from a few bleached grains to coatings 1/8 inch thick. The lower B2t horizon has thin, continuous clay films on peds and in pores and a few clean mineral grains on the surfaces.

NARCISSE SERIES

The Narcisse series is in the Xeroll suborder, a division of the Mollisol order. Profile of Narcisse silt loam in pasture 460 feet south of powerline pole in farmstead fence corner in S1/2 sec. 35, T. 25 N., R. 44 E., W.M.—

A11—0 to 8 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; slightly acid (pH_5 6.4); clear, smooth boundary. 7 to 10 inches thick.

A12—8 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; neutral (pH_5 6.6); abrupt, smooth boundary. 3 to 7 inches thick.

C1—14 to 25 inches, grayish-brown (10YR 5/2) loam or silt loam, brown (10YR 3/3) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; neutral (pH_5 6.6); clear, wavy boundary. 8 to 13 inches thick.

IIC2—25 to 34 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, fine, dark-brown (7.5YR 4/4) mottles; abundant roots; many very fine pores; neutral (pH_5 6.8); clear, wavy boundary. 7 to 10 inches thick.

IIIC3—34 to 48 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, fine, dark-brown (7.5YR 4/4) mottles; plentiful roots; many very fine pores; neutral (pH_5 6.8); abrupt, wavy boundary. 10 to 20 inches thick.

IVC4—48 to 62 inches +, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, fine, dark-brown (7.5YR 4/4) mottles; plentiful roots; many very fine pores; neutral (pH_5 6.8). 14 to 25 inches thick.

A thin O horizon is present where the soil is undisturbed. The A horizon ranges from black to very dark grayish brown when moist. In some places the A and C1 horizons are loam, very fine sandy loam, or silt loam in texture and contain an appreciable amount of sand. In places the soil is gravelly or contains small amounts of gravel throughout. The lower C horizon is medium-textured or moderately coarse textured and is commonly stratified with sand. Mottles in the C horizon range from faint to distinct.

NEZ PERCE SERIES[6]

The Nez Perce series is representative of the Alboll suborder, a division of the Mollisol order. Following the profile description and range of characteristics, this series is compared with the Latah series, which is also in the Alboll suborder.

Profile of Nez Perce silt loam, cultivated, 500 feet east and 150 feet north of the junction of Bigelow Gulch Road and Pleasant Prairie Road in the SW1/4SE1/4NE1/4 sec. 29, T. 26 N., R. 44 E., W.M.—

Ap—0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; slightly acid (pH_5 6.4); abrupt, smooth boundary. 6 to 8 inches thick.

A1—7 to 18 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, coarse prismatic structure that breaks readily to very fine granular structure; slightly hard when dry, friable when moist; slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.6); clear, smooth boundary. 8 to 12 inches thick.

A2—18 to 27 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; few, fine, black concretions; neutral (pH_5 6.8); abrupt, smooth boundary. 1 to 10 inches thick.

B21t—27 to 47 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) when moist; strong, medium, columnar structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few roots; many very fine pores; moderately thick, continuous clay films on ped surfaces, and interstitial pores nearly filled with colloid; few dark-gray stains on ped surfaces; few, fine, black concretions; neutral (pH_5 7.2); clear, wavy boundary. 12 to 24 inches thick.

B22t—47 to 66 inches, light-brown (7.5YR 6/4) silty clay loam, dark brown (7.5YR 4/4) when moist; strong, fine, angular blocky structure; hard when dry, very firm when moist, very sticky and very plastic when wet; few roots; many very fine pores; moderately thick, continuous clay films on ped surfaces and in pores; strongly effervescent material in thin seams, in pockets, and as fine concretions; matrix noneffervescent; mildly alkaline (pH_5 7.6); clear, wavy boundary. 12 to 24 inches thick.

B3—66 inches +, light-brown (7.5YR 6/4) light silty clay loam, brown (7.5YR 5/4) when moist; laminated; hard when dry, firm when moist, sticky and plastic when wet; no roots; few very fine pores; common, thin clay films and dark-gray stains on laminated surfaces; neutral (pH_5 7.2).

The A1 horizon is black or very dark gray when moist and ranges in thickness from 14 to 20 inches. The A2 horizon is silt loam or very fine sandy loam. The B2t horizon is heavy silty clay loam, silty clay, or clay. In some places bedrock occurs at a depth of less than 60 inches. The profile is generally noncalcareous, but lime may occur in seams below a depth of 40 inches.

The large quantity of organic matter that has accumulated in the Ap and A1 horizons has caused the dark color and granular structure of those layers. The light color of the A2 horizon has been caused by water moving downward and laterally (above the slowly permeable B2t horizon) and stripping iron and organic matter from the surfaces of mineral grains. Both clay and lime have been removed from the A horizon and deposited in the B2t horizon, as indicated by the presence of clay films on ped surfaces and lime in seams. Reaction increases slightly with depth, indicating greater removal of bases in the upper part of the soil than in the lower part. Mottles, which are present in places in the B horizon, and the dark-

[6] The Nez Perce soils in this county have a somewhat thicker A2 horizon than normal Nez Perce soils, and they contain volcanic ash, but otherwise they fit the concept of the Nez Perce series. As additional information about these soils becomes available, it may be necessary to recognize them as a separate series.

colored concretions in the A2 horizon result from impeded drainage. The structure of the B2t horizon is strong, because this horizon shrinks and swells appreciably as the moisture content changes. Nez Perce soils formed in layered parent material; the lower layers are apparently very old.

Latah soils are similar to Nez Perce soils in development and horizonation. Their A horizon is thicker, however, because they are subject to overflow and fresh sediments are deposited periodically. They are more strongly gleyed and mottled than Nez Perce soils because they are wetter.

PALOUSE SERIES

The Palouse series is in the Xeroll suborder, a division of the Mollisol order. Profile of Palouse silt loam, moderately shallow, cultivated, in SW¼NE¼SE¼ sec. 11, T. 22 N., R. 44 E., W.M., 240 feet north of Rattler Run Road and 3/10 mile east of railroad viaduct in a cultivated field—

Ap1—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.6); abrupt, smooth boundary. 6 to 9 inches thick.

A12p—9 to 13 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, platy structure; hard when dry, friable when moist, sticky and plastic when wet; abundant roots; many fine pores; neutral (pH_5 6.8); clear, wavy boundary. 6 to 9 inches thick.

B21—13 to 18 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant roots; many fine pores; thin siliceous coatings in pores and on peds; neutral (pH_5 6.8); clear, wavy boundary. 4 to 6 inches thick.

B22—18 to 29 inches, yellowish-brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant roots; many fine pores; thin siliceous coatings in pores and on peds; neutral (pH_5 7.0).

IIR—29 inches +, basalt bedrock.

In places the A1 horizon is black. In some places a few basalt fragments occur on the surface and throughout the profile. Basalt bedrock is at a depth of 20 to more than 60 inches.

PEONE SERIES

The Peone series is in the Aquept suborder, a division of the Inceptisol order. Profile of Peone silt loam in pasture 300 feet west of Bridge No. 4602 on Forker-Peone Road in SE¼SE¼NE¼ sec. 5, T. 26 N., R. 44 E., W.M.—

A11—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, platy structure that breaks to moderate, medium, granular structure; slightly hard when dry, friable when moist; slightly acid (pH_5 6.4); abrupt, smooth boundary. 4 to 7 inches thick.

A12g—6 to 11 inches, gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; moderate, fine, platy structure that breaks to moderate, medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common very fine and fine pores; few, dark-brown (7.5YR 4/4) mottles; neutral (pH_5 6.6); abrupt, smooth boundary. 4 to 6 inches thick.

C1g—11 to 30 inches, gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; common very fine and fine pores; common, medium, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; neutral (pH_5 6.6); clear, wavy boundary. 18 to 22 inches thick.

C2g—30 to 42 inches, light-gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; few roots; common, very fine and fine pores; common, medium, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; slightly acid (pH_5 6.2); clear, wavy boundary. 10 to 14 inches thick.

C3g—42 to 60 inches +, light-gray (2.5Y 7/2) loamy coarse sand, grayish brown (2.5Y 5/2) when moist; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; common, medium, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; medium acid (pH_5 6.0).

The A11 horizon, when moist, is very dark grayish brown to black. The texture of the upper C horizon, above a depth of 30 inches, ranges from very fine sandy loam to silt loam, and the mottles are common, fine, and prominent or common, medium, and distinct. Layers of pure pumicite and diatomite are common in the C horizon and range from 2 to 12 inches in thickness. The lower C horizon is stratified, the texture ranging from silt loam to loamy coarse sand.

PHOEBE SERIES

The Phoebe series is in the Xeroll suborder, a division of the Mollisol order. Profile of Phoebe sandy loam, cultivated, 260 feet south of highway station No. 521 and 120 feet west of center of primary State Highway No. 3 in SE¼SW¼ sec. 7, T. 27 N., R. 43 E., W.M.—

Ap—0 to 8 inches, dark-gray (10YR 4/1) sandy loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; abundant roots; slightly acid (pH_5 6.2); abrupt, smooth boundary. 0 to 10 inches thick.

A1—8 to 16 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) when moist; massive; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.4); clear, wavy boundary. 6 to 10 inches thick.

B2—16 to 25 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.6); gradual, wavy boundary. 8 to 12 inches thick.

C1—25 to 34 inches, light yellowish-brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.6); gradual, wavy boundary. 8 to 12 inches thick.

C2—34 to 44 inches, light yellowish-brown (10YR 6/4) loamy sand, dark yellowish brown (10YR 4/4) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; neutral (pH_5 6.6); gradual, wavy boundary. 8 to 12 inches thick.

C3—44 to 60 inches +, very pale-brown (10YR 7/4) sand, nearly loamy sand; yellowish brown (10YR 5/4) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few roots; porous; neutral (pH_5 6.6).

The A horizon is very dark brown to black when moist and is 14 to 20 inches thick. In some places there are dark-brown, irregular, wavy bands of sandy loam, ¼ to ½ inch thick, in the C horizon. In places some layers in

the C horizon approach a 7.5YR hue. Basalt bedrock may occur within a depth of 36 inches, but more commonly the C horizon grades to sand at a depth greater than 40 inches.

REARDAN SERIES

The Reardan series is in the Ustoll suborder, a division of the Mollisol order. Profile of Reardan silt loam, cultivated, 3,200 feet north and 50 feet west of junction of Coulee Hite Road and Sunset Highway in SE¼SE¼NE¼ sec. 20, T. 25 N., R. 40 E., W.M.—

Ap1—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.6); clear, smooth boundary. 7 to 10 inches thick.

A12—9 to 16 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common very fine and fine pores; neutral (pH_5 6.8); clear, wavy boundary. 6 to 10 inches thick.

A2—16 to 20 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that breaks to weak, fine and medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful roots; many very fine pores; mineral grains mainly clean; neutral (pH_5 7.0); abrupt, wavy boundary. 2 to 5 inches thick.

B2t—20 to 33 inches, pale-brown (10YR 6/3) light silty clay, dark yellowish brown (10YR 4/4) when moist; moderate, coarse, prismatic structure that breaks to strong, medium, angular blocky structure; very hard when dry, extremely firm when moist, very sticky and very plastic when wet; few roots confined to cleavage planes; many very fine inped pores; thin, continuous clay films on ped faces and in pores, and common clean mineral grains on surfaces; neutral (pH_5 7.3); gradual, wavy boundary. 10 to 14 inches thick.

B3ca—33 to 60 inches +, very pale brown (10YR 7/4) silt loam; dark yellowish brown (10YR 4/4) when moist; weak, coarse, prismatic structure; hard when dry, friable when moist, sticky and plastic when wet; few roots; many very fine pores; few, thin, patchy clay films; slightly effervescent, most pores coated with lime; moderately alkaline (pH_5 8.3).

The A horizon, when moist, ranges from very dark brown (10YR 2/2) to black (10YR 2/1). The texture of the B horizon ranges from heavy silty clay loam to silty clay. Lime is at a depth of 30 to 50 inches. Some gravel may be present in the solum. Bedrock, in some places, occurs at a depth of more than 40 inches.

SCHUMACHER SERIES

The Schumacher series is in the Xeroll suborder, a division of the Mollisol order. Profile of Schumacher silt loam, cultivated, 0.2 mile west and 50 feet south of junction of Latah cutoff road and Painter Road NE¼NW¼ sec. 15, T. 21 N., R. 45 E., W.M.—

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; medium acid (pH_5 6.0); clear, smooth boundary. 6 to 9 inches thick.

A1—7 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; medium acid (pH_5 6.0); clear, smooth boundary. 3 to 7 inches thick.

B1—11 to 21 inches, very pale brown (10YR 7/3) gravelly silt loam, brown (10YR 5/3) when moist; moderate, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; most mineral grains are clean, but a few very thin, colloidal coatings are present in pores; medium acid (pH_5 6.0); clear, wavy boundary. 8 to 12 inches thick.

B21t—21 to 31 inches, very pale brown (10YR 7/3) gravelly heavy loam, with light-brown (7.5YR 6/4) and yellowish-brown (10YR 5/4) coatings that are brown (7.5YR 5/4) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; many very fine and fine pores; common thin clay films on ped faces; continuous, thin clay films in tubular pores and in a few interstitial pores; many clean mineral grains on ped faces and in pores; few, fine, yellow mottles; slightly acid (pH_5 6.2); gradual, wavy boundary. 8 to 12 inches thick.

B22t—31 to 53 inches, very pale brown (10YR 7/3) gravelly heavy loam with dark-brown (7.5YR 3/2 to 4/4) coating, brown (7.5YR 5/4) with reddish-brown (5YR 4/4) coating when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; common very fine and fine pores; moderately thick, discontinuous, reddish-brown clay films on some ped faces; thin clay films on others; thin, continuous clay films in tubular pores, few thin clay films in interstitial pores; many clean mineral grains on ped faces and in pores; few black stains and concretions; slightly acid (pH_5 6.4); clear, wavy boundary. 18 to 25 inches thick.

B3t—53 to 72 inches +, very pale brown (10YR 7/3) gravelly clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine and fine pores; few, thin, reddish-brown clay films on ped faces and thin, continuous clay films in most tubular pores; many clean mineral grains on surfaces of peds and in pores, and these grade to decomposing shale and sandstone; neutral (pH_5 6.6). 5 to 15 inches thick.

The A1 horizon, when moist, is very dark brown or black. In many areas this horizon is gravelly. The texture of the B2t horizon ranges from gravelly heavy loam to gravelly silty clay loam. The lower part of the profile varies in content of shale and sandstone gravel. Bedrock is below a depth of 40 inches.

SEMIAHMOO SERIES

The Semiahmoo series is the only series in this county that is in the Histisol order. This series has not been placed in a suborder because no categories between the series and the Histisol order have been developed. Profile of Semiahmoo muck, cultivated, 350 feet west of Saltese Road and 10 feet north of division fence in the NE¼SE¼ SW¼ sec. 28, T. 25 N., R. 45 E., W.M.—

0 to 8 inches, dark-gray (5YR 4/1) muck, black (5YR 2/1) when moist; moderate, fine and medium, granular structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; abundant roots; medium acid (pH_5 5.8); abrupt, smooth boundary.

8 to 17 inches, dark-gray (5YR 4/1) muck, black (5YR 2/1) when moist; moderate, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; 1-inch layer of brown (10YR 5/3) diatomite; medium acid (pH_5 5.8); abrupt, smooth boundary.

17 to 21 inches, black (5YR 2/1) fibrous peat, black (10YR 2/1) when moist; strong, fine, platy structure; hard

when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many fine and medium pores; medium acid (pH$_5$ 5.8); abrupt, smooth boundary.

21 to 30 inches, gray (10YR 5/1) fibrous peat, dark reddish brown (5YR 3/2) when moist, darkening to dark reddish brown (5YR 2/2) upon exposure to air; finely laminated; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; many fine and medium pores; vegetative remains of tules readily identifiable; medium acid (pH$_5$ 5.6); clear, smooth boundary.

30 to 42 inches, gray (10YR 5/1) raw sedge peat, dark reddish brown (5YR 3/2) when moist, darkening rapidly to black (5YR 2/1) upon exposure to air; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine and medium pores; vegetative remains of tules, reeds, and sedges readily identifiable; medium acid (pH$_5$ 5.7); clear, smooth boundary.

42 to 52 inches, gray (10YR N 5/0), disintegrating and raw sedge peat, dark brown (7.5YR 4/4) when moist, darkening rapidly to black (5YR 2/1) upon exposure to air; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine pores; vegetative remains of tules, reeds, and sedges identifiable; medium acid (pH$_5$ 5.8); clear, smooth boundary.

52 to 60 inches, gray (10YR 5/1) raw sedge peat, dark yellowish brown (10YR 3/4) when moist, darkening rapidly to dark reddish brown (5YR 2/2) on exposure to air; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; few fine roots; vegetative remains of tules identifiable; medium acid (pH$_5$ 5.8).

The muck surface layer is 7 to 24 inches thick, and the pumice layer is 2 to 12 inches thick. Bedrock or a layer of mineral soil may be present below a depth of 20 inches.

These soils occupy flats and depressions where water stands on the surface. Vegetation accumulates in these areas as fast as, or faster than, it can decompose. The uppermost 17 inches of the Semiahmoo soil described consists of muck, and the material below of peat. If the plant material has decomposed to the extent that it cannot be recognized, the material is classified as muck; if plant material can still be recognized, the material is classified as peat. Peat is the parent material from which muck forms, although muck may form without any perceptible peat stage.

The fact that plant remains are still recognizable below a depth of 17 inches in the Semiahmoo soil indicates that organic material accumulated more rapidly than it decomposed. That plant remains are no longer identifiable in the upper 17 inches indicates that decomposition is going on as rapidly as, or more rapidly than, accumulation.

SNOW SERIES

The Snow series is in the Xeroll suborder, a division of the Mollisol order. Profile of Snow silt loam, cultivated, in SW¼SW¼SW¼NW¼ sec. 3, T. 21 N., R. 44 E., W.M., 40 feet north of Latah-Waverly Road—

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH$_5$ 7.0); abrupt, smooth boundary. 6 to 10 inches thick.

A11—8 to 12 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common, very fine and fine, tubular pores; neutral (pH$_5$ 7.0); abrupt, smooth boundary. 3 to 8 inches thick.

A12—12 to 21 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; massive or weak, medium, prismatic structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common, very fine, tubular pores; neutral (pH$_5$ 7.2); clear, wavy boundary. 6 to 12 inches thick.

B2—21 to 36 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; few fine, and common very fine, tubular pores; neutral (pH$_5$ 7.2); clear, smooth boundary. 10 to 20 inches thick.

C1—36 to 44 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; few fine, and common very fine, tubular pores; neutral (pH$_5$ 7.2); clear, wavy boundary. 6 to 12 inches thick.

C2—44 to 60 inches +, pale-brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; many, fine and medium, tubular pores; discontinuous gray coatings on ped surfaces; neutral (pH$_5$ 6.8).

The A horizon is very dark brown to black when moist and is 18 to 30 inches thick. In places it is very fine sandy loam. The B2 horizon may have discontinuous, faint to prominent coatings of clean mineral grains and some thin, discontinuous clay films on ped surfaces. In places there are a few faint mottles in the lower part of the C horizon. Lake sediments may be present below a depth of 48 inches.

SPEIGLE SERIES

The Speigle series is in the Xeroll suborder, a division of the Mollisol order. Profile of Speigle very stony silt loam in woodland 30 feet south of Pine Bluff Road, 1 mile from its junction with Nine Mile Road, in NE¼NW¼ sec. 12, T. 26 N., R. 41 E., W.M.—

A1—0 to 8 inches, grayish-brown (10YR 5/2) very stony silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; neutral (pH$_5$ 7.0); clear, wavy boundary. 6 to 11 inches thick.

B2—8 to 18 inches, pale-brown (10YR 6/3) very cobbly loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, subangular blocky structure; hard when dry, friable when moist, sticky and slightly plastic when wet; plentiful roots; many very fine pores; few, thin, discontinuous clay films on rock fragments; neutral (pH$_6$ 6.8); gradual, wavy boundary. 8 to 12 inches thick.

C—18 to 60 inches, light-gray (10YR 7/2) very cobbly heavy loam, nearly sandy clay loam; grayish brown (10YR 5/2) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and slightly plastic when wet; plentiful roots; few very fine pores; thin, continuous, brownish-yellow (10YR 6/6) coatings on some ped surfaces; common, fine, black coatings and soft aggregates; neutral (pH$_5$ 6.8).

The A1 horizon, when moist, is very dark brown to very dark grayish brown. Cobblestones and stones cover from 50 to 80 percent of the surface. The texture of the B2 horizon may be cobbly silt loam or very cobbly loam, and from 40 to 70 percent of it may consist of basaltic

cobblestones and stones. Lenses or pockets of pumicite are common in the B and C horizons.

SPOKANE SERIES

The Spokane series is in the Xeroll suborder, a division of the Mollisol order. Profile of Spokane loam in woodland in SE¼NE¼SE¼ sec. 1, T. 26 N., R. 44 E., W.M., 250 feet west of junction of farm road and Newman Lake Road, at a point 110 feet south of Newnan Lake Road—

O—1 inch to 0, very dark brown or dark grayish-brown, loose, partly decomposed organic litter, composed of pine needles, leaves, twigs, and cones; strongly acid (pH_5 5.5); abrupt, smooth boundary.

A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry; friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.4); clear, smooth boundary. 2 to 7 inches thick.

A3—3 to 9 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant roots; many very fine pores; slightly acid (pH_5 6.2); clear, smooth boundary. 4 to 10 inches thick.

B2—9 to 17 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonplastic and nonsticky when wet; plentiful roots; many very fine pores; very few thin clay films in pores and on mineral grains; slightly acid (pH_5 6.3); clear, wavy boundary. 6 to 12 inches thick.

C1—17 to 25 inches, pale-brown (10YR 6/3) gravelly loamy coarse sand, dark brown (10YR 4/3) when moist; massive; soft when dry, friable when moist, nonplastic and nonsticky when wet; plentiful roots; many very fine pores; few, irregular, horizontal bands of dark yellowish-brown (10YR 4/4, moist) loam, 2 to 5 millimeters thick, containing thin clay films in pores; slightly acid (pH_5 6.5); gradual, irregular boundary. 6 to 15 inches thick.

C2—25 to 52 inches +, pale-brown, light-gray, and gray (10YR 6/3, 7/2, and 5/1), soft to hard, disintegrating granite bedrock; crumbles to angular sand and fine gravel; few roots; neutral (pH_5 6.9).

The A1 horizon, when moist, is very dark grayish brown to dark brown. The C horizon ranges from gravelly loamy sand to gravelly sandy loam. The bands in the lower part of the profile are ⅛ to ½ inch thick; in some places there are none. The depth to disintegrating bedrock ranges from 1 to 5 feet. An R horizon is present at a depth greater than 20 inches.

SPRINGDALE SERIES

The Springdale series is in the Xeroll suborder, a division of the Mollisol order. Profile of Springdale gravelly coarse sandy loam in woodland 0.5 mile west of junction of U.S. Highway 195 and Colbert Road, at a point 74 feet east of an unimproved road and 440 feet north of Colbert Road in the SW¼SW¼NE¼ sec. 22, T. 27 N., R. 43 E., W.M.—

O—1 inch to 0, very dark brown to grayish-brown, partly decomposed organic litter consisting of pine needles, leaves, twigs, and cones; strongly acid (pH_5 5.4); abrupt, smooth boundary.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant roots; porous; neutral (pH_5 6.6); abrupt, smooth boundary. 1 to 3 inches thick.

AC—2 to 6 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; slightly acid (pH_5 6.5); clear, wavy boundary. 3 to 6 inches thick.

C1—6 to 12 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; many very fine pores; medium acid (pH_5 6.0); clear, wavy boundary. 3 to 8 inches thick.

C2—12 to 24 inches, light yellowish-brown (10YR 6/4) gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; porous; slightly acid (pH_5 6.3); clear, wavy boundary. 8 to 12 inches thick.

IIC3—24 to 46 inches +, multicolored dark-gray, very pale brown, and light-gray gravelly coarse sand; single grain; loose when moist or dry, nonsticky and nonplastic when wet; few roots; porous; neutral (pH_5 6.6).

The A horizon is gravelly loamy sand or gravelly sandy loam and, when moist, is very dark grayish brown to very dark brown. The C horizon is stratified; it ranges from gravelly loamy coarse sand to gravelly sandy loam in texture and from dark brown to dark yellowish brown in color when moist. In some places the underlying gravel is coated with fines and also contains reddish-brown iron stains. Gravel commonly is at a depth of 20 to 36 inches. Cobblestones and stones are common. The steeper soils of this series tend to be somewhat coarser textured and to have a lower chroma throughout.

TEKOA SERIES

The Tekoa series is in the Xeroll suborder, a division of the Mollisol order. Profile of Tekoa gravelly silt loam in woodland 1,500 feet north and 100 feet west of center of sec. 24, T. 21 N., R. 45 E., W.M.—

O—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

A1—0 to 5 inches, brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; neutral (pH_5 6.6); clear, wavy boundary. 5 to 7 inches thick.

B1—5 to 14 inches, pale-brown (10YR 6/3) gravelly silt loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common fine and many very fine pores; few thin clay films in pores; few clean mineral grains; slightly acid (pH_5 6.4); clear, wavy boundary. 7 to 12 inches thick.

B2t—14 to 20 inches, pale-brown (10YR 6/3) gravelly heavy silt loam, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful roots; many very fine and fine pores; many thin clay films on ped faces and in pores; clean mineral grains cover ped surfaces; medium acid (pH_5 5.8); gradual, wavy boundary. 5 to 9 inches thick.

C1—20 to 38 inches, very pale brown (10YR 7/3) very gravelly loam, yellowish brown (10YR 5/4) when moist; massive or finely laminated; few roots; soft, fine-grained siltstone and sandstone; medium acid (pH_5 5.6). 18 to 25 inches thick.

R—38 inches +, fractured sandstone.

The A1 horizon ranges from brown to dark brown in color. The B2t horizon is gravelly heavy silt loam or gravelly heavy loam. Clay films are thin and discontinuous or moderately thick. The gravel content ranges from 25 to 50 percent in the B2t horizon. Fractured bedrock occurs at a depth of 24 to 40 inches.

UHLIG SERIES

The Uhlig series is representative of the Xeroll suborder, a division of the Mollisol order. Following the profile description and range of characteristics, this series is compared with the Garrison, Glenrose, Hesseltine, Lakesol, Larkin, Naff, Narcisse, Palouse, Phoebe, Schumacher, Snow, Speigle, Spokane, Springdale, and Tekoa series, all of which are also in the Xeroll suborder.

Profile of Uhlig silt loam, cultivated, 1,000 feet north and 100 feet west of the end of Scott Road, directly under powerline near center of NW¼ sec. 20, T. 26 N., R 44 E., W.M.—

Ap1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine and medium, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common fine pores; medium acid (pH_5 6.0); abrupt, smooth boundary. 4 to 9 inches thick.

Ap2—4 to 10 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, fine and medium, platy structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common fine pores; slightly acid (pH_5 6.3); abrupt, smooth boundary. 4 to 9 inches thick.

A1—10 to 18 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common very fine pores; neutral (pH_5 6.6); clear, wavy boundary. 4 to 10 inches thick.

B21t—18 to 32 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure that breaks to moderate, medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many very fine pores; thin, patchy clay films on ped surfaces and in pores; neutral (pH_5 6.6); clear, wavy boundary. 4 to 10 inches thick.

B22t—32 to 42 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; few thin clay films in pores; many nodules 1/4 to 3/8 inch in diameter that are dark brown (7.5YR 4/4) when moist; neutral (pH_5 6.8); gradual, wavy boundary. 12 to 20 inches thick.

C1—42 to 60 inches +, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) when moist; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; few roots; many very fine pores and few fine pores; neutral (pH_5 6.8).

The A horizon ranges from black to very dark brown in color when moist and from 16 to 20 inches in thickness. The texture of the B2 horizon is loam or silt loam. Some gravel occurs throughout the profile, and gravel makes up 5 to 25 percent of some layers in the C horizon. Some areas are moderately deep to bedrock. In places there is a slight accumulation of lime in the lower part of the C horizon.

Organic matter, the residue of the thick bunchgrass vegetation under which Uhlig soils formed, is responsible for the dark color of the Ap1 and Ap2 horizons and the granular structure of the Ap1. Undoubtedly the Ap2 horizon was granular before cultivation. Free lime has been removed from these soils, except in a few places where it is present in the lower part of the C horizon. The pH increases rather uniformly with depth from medium acid in the Ap1 horizon to neutral in the C1, indicating that some leaching has taken place. The thin, patchy clay films in the B21t and B22t horizons indicate that some clay has moved from the A horizon and has been deposited in the B, or that clay has formed in the B and has become concentrated on a few ped faces and in pores. The Bt horizons contain only slightly more clay than the A, and in places, may actually contain less. The structure of the Bt horizons is weak because of the low shrink-swell potential of the material in these horizons.

Phoebe soils are similar to Uhlig soils in horizonation and evidences of development but have a much thinner solum and lack clay films in the B horizon because they formed in coarser parent material that was resistant to weathering.

Spokane and Lakesol soils have a lighter colored, thinner A horizon than Uhlig soils because the grass cover was more sparse. The B horizon of Spokane soils is only 6 to 12 inches thick due to the resistance of the underlying parent rock to weathering. The B horizon of Lakesol soils, however, is only 9 to 15 inches thick because of the moderately slow permeability of the coarsely laminated underlying lake sediments.

Palouse soils resemble Uhlig soils in horizonation and soil development, but they have moderate structure in the B horizon because they contain more clay and consequently have a greater shrink-swell potential. The thin, siliceous coatings on peds and in pores in the B21 and B 22 horizons of Palouse soils appear to be the result of stripping of the mineral grains by water moving through the soil. At the location of the profile described in this section of the report, Palouse soil is thinner than Uhlig because bedrock is at a moderately shallow depth.

Narcisse and Snow soils differ from Uhlig soils in horizonation and development in two principal ways. In many places they are dark colored and high in content of organic matter to a greater depth because they periodically receive fresh deposits of sediments. In addition, they have even less evidence of subsoil development, because they are so young.

The Glenrose, Hesseltine, Larkin, Naff, Schumacher, and Tekoa soils differ from Uhlig soils mainly in the degree of development of the B horizon. Their B horizon contains considerably more clay than the A horizon, and oriented clay films in the B horizon are more evident than in Uhlig soils. (See laboratory data for Hesseltine silt loam in the subsection "Chemical and Physical Properties of Soils.") This can be attributed to a difference in content of minerals that readily weather into clay, to a difference in length of time the soils have been in place, or to a combination of the two.

The total thickness of the A and B horizons of Hesseltine and Tekoa soils is much less than the thickness of these horizons in Uhlig soils. Tekoa soils are thin because the lower part has formed in hard rock resistant to weathering, and Hesseltine soils are thin because the lower part consists mainly of gravel and cobblestones, which are also resistant to weathering.

The solum of Glenrose, Larkin, and Naff soils is thick, apparently because the soil material was deposited in layers and the soil-forming processes in the lower part have been going on for a long time.

Garrison, Speigle, and Springdale soils resemble Uhlig soils in horizonation and development but are considerably coarser textured and contain much gravel and stone. They have a thinner solum than Uhlig soils because the coarse material is resistant to weathering. Evidence of clay formation and movement is lacking, except for a few, thin clay films on rock fragments in places in the B horizon of Speigle soils.

VASSAR SERIES

The Vassar series is in the Orthod suborder, a division of the Spodosol order. Profile of Vassar silt loam in woodland, 500 feet west of junction of Mount Spokane Summer Road and main Mount Spokane Road, in section 16, T. 28 N., R. 45 E., W.M.—

O1—1½ inches to 0, very dark grayish-brown, loose, partly decomposed organic litter composed of needles, leaves, and twigs; medium acid (pH_5 6.0); abrupt, smooth boundary.

A2—0 to ½ inch, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant roots; medium acid (pH_5 5.8); abrupt, smooth boundary. 0 to 1 inch thick.

B21ir—½ inch to 6 inches, light-brown (7.5YR 6/4) silt loam, dark brown (7.5YR 3/4) when moist; weak, medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; common fine pores; medium acid (pH_5 6.0); clear, wavy boundary. 4 to 12 inches thick.

B22ir—6 to 15 inches, dark yellowish-brown (10YR 7/4) silt loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many fine pores; slightly acid (pH_5 6.2); clear, wavy boundary. 8 to 18 inches thick.

IIB23ir—15 to 22 inches, light-brown (7.5YR 6/4) loam, dark brown (7.5YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common fine pores; medium acid (pH_5 5.8); clear, smooth boundary. 5 to 10 inches thick.

IIIC1—22 to 33 inches, very pale brown (10YR 8/3) gravelly loam, yellowish brown (10YR 6/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many fine pores; medium acid (pH_5 5.7); gradual, wavy boundary. 8 to 14 inches thick.

IIIC2—33 to 55 inches, very pale brown (10YR 8/3) gravelly loam, pale brown (10YR 6/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; medium acid (pH_5 5.5); gradual, wavy boundary. 15 to 24 inches thick.

IIIR—55 inches +, gneiss bedrock.

The depth to bedrock ranges from 36 to more than 60 inches.

WETHEY SERIES

The Wethey series is in the Orthent suborder, a division of the Entisol order. Profile of Wethey loamy sand in grassland, 200 feet east of the bridge on old U.S. Highway 395, in the NW¼NW¼NE¼ sec. 31, T. 28 N., R. 43 E., W.M.—

C1—0 to 23 inches, speckled light-gray, dark-gray, and yellowish-brown (10YR 7/1, 4/1, and 5/4) stratified loamy sand and sand, light gray to black, grayish brown, and brown (10YR 7/1 to 2/1, 5/2, and 4/3) when moist; single grain; loose when dry and when moist; abundant roots; porous; few, fine, brown stains; otherwise, mineral grains are clean; neutral (pH_5 7.0); abrupt, smooth boundary. 20 to 40 inches thick.

IIC2—23 to 45 inches, grayish-brown (10YR 5/2) fine sandy loam, near loamy fine sand; very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist; plentiful roots; many, very fine, dark-brown (7.5YR 4/4) mottles; otherwise, mineral grains are clean; neutral (pH_5 6.8); abrupt, smooth boundary.

IIIC3g—45 to 52 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, prismatic structure; hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful roots; common, fine and medium pores; common, fine, dark-brown (7.5YR 4/4) mottles; otherwise, mineral grains are clean; contains lenses of sand and loamy sands; neutral (pH_5 6.7); abrupt, smooth boundary.

IVC4g—52 to 60 inches, gray (10YR 5/1) heavy silt loam, very dark gray (10YR 3/1) when moist; weak, coarse, prismatic structure; hard when dry, friable when moist, sticky and plastic when wet; few roots; many fine pores; few, medium, distinct, dark-brown (7.5YR 4/4) mottles; otherwise mineral grains are clean; small pockets of sand; neutral (pH_5 6.6).

The profile is commonly stratified with layers of sand, loamy sand, and silt loam. The uppermost 3 feet is predominantly coarse textured and moderately coarse textured, but the lower layers commonly include finer textured strata. The surface layer, when moist, ranges in color from dark gray to very dark brown, although the color depends upon the proportion of the clean mineral grains. In most places mottles occur within 2 feet of the surface.

WOLFESON SERIES

The Wolfeson series is in the Ochrept suborder, a division of the Inceptisol order. Profile of Wolfeson very fine sandy loam, cultivated, 450 feet south and 1,000 feet west of junction of Spotted Road and Montgomery Road, in NW¼NE¼ sec. 29, T. 29 N., R. 42 E., W.M.—

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, platy structure that breaks to medium granular structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; plentiful roots; many very fine pores; organic matter in discrete particles and aggregates; mineral grains mainly clean; slightly acid (pH_5 6.4); abrupt, smooth boundary. 4 to 8 inches thick.

B21—7 to 17 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; many fine pores; common, medium, dark-brown (7.5YR 3/4) mottles; few very thin clay films in pores; organic matter as above; mineral grains nearly clean; slightly acid (pH_5 6.4); clear, wavy boundary. 6 to 12 inches thick.

B22—17 to 35 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; massive; very hard when dry, firm when moist, nonsticky and nonplastic when wet; few roots; few fine pores; many, fine and medium, dark-brown (7.5YR 4/4) mottles; two discontinuous, dark-brown (7.5YR 4/4), wavy bands ⅛ inch thick that have thin clay films in a few pores; soil firmer adjacent to bands; mineral grains clean except in mottles and around clay films; neutral (pH_5 6.6); clear, wavy boundary. 10 to 28 inches thick.

IIB23t—35 to 44 inches, light-gray (2.5Y 7/2) clay loam, grayish brown (10YR 5/2) when moist; moderate, medium, prismatic structure that breaks to moderate,

medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine pores; many, medium and common, large, dark-brown (7.5YR 4/4) mottles; few thin and moderately thick clay films on prism faces, in tubular pores, and adjacent areas; few black stains; most mineral grains are clean; neutral (pH_5 6.6); clear, wavy boundary. 7 to 12 inches thick.

IIIC1—44 to 51 inches, light yellowish-brown (2.5Y 6/4) loamy fine sand, olive brown (2.5Y 4/4) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few roots; many fine pores; many fine dark-brown (7.5YR 4/4) mottles; otherwise mineral grains are clean; neutral (pH_5 6.8); clear, smooth boundary. 5 to 10 inches thick.

IVC2—51 to 60 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few roots; many very fine and few medium pores; many, coarse, dark-brown (7.5YR 4/4) mottles; common thin and moderately thick clay films in tubular pores and few in bridges between mineral grains, some with gray, clean silt coatings; ped surfaces and some pores covered with clean mineral grains; neutral (pH_5 6.6).

In undisturbed areas a thin O horizon is present. The texture of the B2 horizon ranges from fine sandy loam to light loam. Horizontal, irregular, wavy, dark-brown bands of finer texture than the matrix are common in the B2 horizon. These bands are 1/4 inch to 3 inches thick. Some weak cementation occurs below a depth of 12 to 30 inches, especially next to the wavy bands. In places, pockets or lenses of sand and gravel occur in the B2 horizon. The IIB23t horizon may be a heavy silt loam, silty clay loam, or clay loam. The depth to his horizon ranges from 24 to 48 inches.

Chemical and Physical Properties of Soils

The chemical and physical properties of selected soils of the Cocollala, Clayton, Freeman, Hesseltine, Spokane, and Springdale series are given in tables 9 and 10. Profiles of these soils are described in the preceding section. The data in the two tables can be used by soil scientists to classify soils and to develop concepts of soil genesis. They can also be used to estimate water-holding capacity, susceptibility to wind erosion, fertility, tilth, and other factors related to soil management.

Field and laboratory methods

All of the samples analyzed were taken from carefully selected pits. The samples are considered representative of the soil material that is made up of particles less than three-fourths of an inch in diameter. The soil material was rolled, crushed, and sieved by hand to remove rock fragments more than 2 millimeters in diameter. Unless otherwise noted, all material that was analyzed passed the 2-millimeter sieve and was oven dry.

Particle size analysis was made by the pipette method (*4*, *5*, *7*). Reaction was measured with a glass electrode at a soil-water ratio of 1 to 1. Organic carbon was determined by wet combustion in a modification of the Walkley-Black method (*8*). The cation exchange capacity was determined by direct distillation of adsorbed ammonia (*8*). Extractable sodium and potassium were determined with a flame spectrophotometer. Free iron oxide was determined by titration of the extract that was obtained when the soil was treated with sodium dithionite.

General Nature of the County

This section contains additional facts about the county. The history and growth of the county are briefly related. The important agricultural developments are discussed and statistics are given on the size and types of farms, the acreage of the principal crops, and the number of livestock. The climate of the county is described. Transportation, industries, markets, and community facilities are also discussed. For those interested in hunting and fishing, there is a brief description of the wildlife population.

Early History and Growth

Spokane County was first established in January 1858. In 1864, it was made a part of Stevens County, but in 1879 was reestablished as Spokane County. In 1883 the present boundaries were established, and the city of Spokane became the county seat.

Spokane, in the language of the Spokane Indians, means "Chief of the Sun." This name was given by early traders to the river, to the first fur trading settlement, and to the Indian inhabitants. It was derived from a famous chief of the Middle Spokane Indians, Illim Spokanee. Spokane Garry, the outstanding Indian in early history of this area, was a son of Spokanee.

At the junction of the Spokane and Little Spokane Rivers, the first trading post, Spokane House, was established in 1810 by British traders of the Canadian Northwestern Fur Company. In 1812, John Jacob Astor's Pacific Fur Company established the Americans' Fort Spokane in the same locality. These companies were purchased by the British of Hudson's Bay Company.

The first permanent settlers came to Spokane Falls in Washington Territory in 1871. After the Northern Pacific Railroad was extended into Spokane in 1881, the county developed rapidly.

As Spokane County was within the land grant of the Northern Pacific Railroad, only every alternate square mile was open for homesteading, but railroad land was available for purchase at a nominal price. The early inhabitants were trappers, miners, railroad men, and stockmen, mainly from the North Central States. The population of the county increased from 966 in 1860 to 278,333 in 1960.

Agriculture

Farming in Spokane County has become increasingly mechanized since 1930. Large tractors have replaced horses and mules, and combine harvesters have replaced stationary threshers. Many of the harvesters are self-propelled and have automatic levelling devices to assure efficient operation on steep slopes.

The total acreage in farms has declined somewhat in recent years, the number of farms has decreased, and the average size has increased. At the time of the 1959 census of agriculture, there were 2,990 farms in the county, the average size was 274.9 acres, and the total area in farms was 822,008 acres. In 1954, there were 3,594 farms, the average size was 229.8 acres, and the total area in farms was 825,785 acres.

TABLE 9.—*Chemical*

[Analyzed by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska. Dashes indicate the

Soil	Horizon	Depth	Cation exchange capacity (NH_4Ac)	Extractable cations (Meq. per 100 grams of soil)		
				Ca	Mg	H
		Inches				
Clayton fine sandy loam.	A1	0 to 3	9.1	3.8	1.4	4.9
	B2ir	3 to 9	6.4	2.7	1.3	4.5
	C1	9 to 18	4.7	2.1	1.1	2.4
	C2	18 to 35	4.2	2.1	.9	2.0
	C3	35 to 54	4.0	2.3	1.1	1.6
	C4	54 to 70+	4.0	2.5	1.0	1.2
	Band [1]	----------	7.9	4.7	2.1	3.2
Cocolalla silty clay loam.	Ap	0 to 5	39.7	23.3	6.6	20.0
	A12	5 to 13	35.5	24.7	6.1	10.0
	C1g	13 to 20	16.9	11.7	3.8	3.1
	C2g	20 to 26	19.4	13.1	4.3	3.5
	C3g	26 to 46	10.2	6.6	2.0	1.9
	IIA1b	46 to 56	23.3	15.7	5.7	6.0
	IIC1b	56 to 62+	21.2	13.8	5.9	4.4
Freeman silt loam.	Ap	0 to 7	13.7	7.6	1.6	9.7
	A21	7 to 12	9.7	5.5	1.9	5.0
	A22	12 to 17	7.9	4.7	1.9	3.9
	A&B	17 to 22	13.7	8.7	3.4	5.1
	B21t [2]	22 to 35	18.3	12.0	5.0	5.9
	B21t [2]	35 to 49	19.1	12.7	4.8	5.1
	B22t	49 to 59	19.0	12.8	4.8	4.3
	B23t	59 to 72+	19.8	13.6	4.8	3.9
Hesseltine silt loam.	A1	0 to 3	16.0	8.0	3.5	9.8
	A3	3 to 6	15.7	8.6	3.9	7.4
	B21t	6 to 13	16.1	8.7	4.7	5.5
	B22t	13 to 17	18.0	10.4	5.7	5.5
	IIC1	17 to 36	19.4	11.7	6.2	3.5
	IIIC2	36 to 60+	17.9	10.3	5.3	3.5
Spokane loam.	A1	0 to 3	16.8	11.2	1.3	8.5
	A3	3 to 9	8.7	5.0	.2	4.6
	B2	9 to 17	6.0	4.1	.4	3.1
	C1	17 to 25	4.8	3.5	.4	1.5
	C2	25 to 52+	6.0	5.9	.5	1.5
Springdale gravelly sandy loam.	A1	0 to 2	15.9	8.6	1.6	9.9
	AC	2 to 6	7.1	3.0	.9	5.0
	C1	6 to 12	6.4	2.4	.9	5.4
	C2	12 to 24	4.9	2.6	.6	2.4
	IIC3	24 to 46+	3.9	2.4	.7	1.2

[1] The band is part of the C4 horizon; it is loamy sand in texture.

analysis of six selected soils

values obtained were not representative of the natural soil or were too low for meaningful interpretation]

Extractable cations (Meq. per 100 grams of soil)—Continued			Base saturation (NH_4Ac exchange)	Base saturation on sum +H	Ca/Mg ratio	pH (1:1 suspension)	Organic matter		C/N ratio	Free iron oxide (Fe_2O_3)
Na	K	Sum					Organic carbon	Nitrogen		
			Percent	*Percent*			*Percent*	*Percent*		*Percent*
----------	0.8	10.9	66	55	2.7	6.0	1.08	0.060	18	0.9
----------	.5	9.0	70	50	2.1	6.1	.46	.027	17	.9
----------	.4	6.0	76	60	1.9	6.3	.15	.014	----------	.9
----------	.4	5.4	81	63	----------	6.6	.10	.010	----------	.8
----------	.2	5.2	90	69	2.1	6.6	.11	----------	----------	.8
----------	.1	4.8	90	75	2.5	6.8	.03	----------	----------	.8
.1	.4	10.5	92	70	2.2	6.7	.04	----------	----------	1.5
.6	.6	51.1	78	61	3.5	5.6	5.16	.364	14.2	1.0
.6	.4	41.8	90	76	4.0	6.5	3.85	.322	12	.5
.5	.2	19.3	96	84	3.1	7.0	.24	.032	----------	.3
.5	.4	21.8	94	84	3.0	7.0	.23	.029	----------	.2
.3	.7	11.5	94	83	3.3	7.2	.04	----------	----------	.3
.2	.5	28.1	95	79	2.8	6.5	.17	----------	----------	.7
.2	.4	24.7	96	82	2.3	6.4	.07	----------	----------	.7
.1	.9	19.9	74	51	4.8	5.7	1.49	.098	15.2	1.2
.1	.7	13.2	84	62	2.9	6.7	.28	.034	8	1.2
.1	.4	11.0	90	64	2.5	6.9	.14	.019	----------	1.2
.2	.4	17.8	93	71	2.6	6.6	.14	.016	----------	1.3
.4	.4	23.7	97	75	2.4	6.6	.12	.018	----------	1.4
.4	.3	23.3	95	78	2.6	6.9	.09	----------	----------	1.4
.5	.2	22.6	96	81	2.7	7.0	.12	----------	----------	1.4
.6	.2	23.1	97	83	2.8	7.3	.08	----------	----------	1.5
----------	1.0	22.3	78	56	2.3	6.0	1.61	.055	29.3	2.6
----------	.8	20.7	85	64	2.2	6.4	.51	.029	18	2.9
----------	.8	19.7	88	72	1.8	6.5	.46	.023	20	2.8
----------	.8	22.4	94	75	1.9	6.6	.29	.019	15	2.6
.1	.5	22.0	95	84	1.9	7.0	.27	.008	34	2.4
.1	.5	19.7	90	82	1.9	7.1	.32	----------	----------	2.5
----------	.7	21.7	78	61	8.6	6.4	2.30	.109	21.1	1.1
----------	.4	10.2	64	55	----------	6.2	.60	.039	15	1.1
----------	.2	7.8	78	60	----------	6.3	.20	.016	----------	1.0
----------	.2	5.6	85	73	----------	6.6	.08	.006	----------	.8
.1	.1	8.1	100	81	----------	6.9	.04	.04	----------	.9
----------	.6	20.7	68	52	5.4	6.2	1.93	.092	21	1.0
----------	.4	9.3	60	46	----------	5.9	.72	.030	24	1.0
.1	.3	9.1	58	41	----------	5.6	.42	.026	16	1.1
----------	.2	5.8	69	59	----------	6.4	.09	.013	----------	.9
----------	.1	4.4	82	73	----------	6.5	.02	----------	----------	.8

[2] The horizon designated B21t in the profile description was separated into two parts for this analysis.

TABLE 10.—*Mechanical analysis of six selected soils*

[Analyzed by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska]

Soil	Horizon	Depth	Particle-size distribution						Clay (less than 0.002 mm.)	Textural class
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)		
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
Clayton fine sandy loam.	A1	0 to 3	2. 4	20. 9	16. 7	16. 6	12. 0	26. 8	4. 6	Sandy loam.
	B2ir	3 to 9	2. 5	22. 2	17. 8	17. 0	11. 9	24. 0	4. 6	Sandy loam.
	C1	9 to 18	2. 0	23. 2	19. 2	18. 4	12. 3	21. 3	3. 6	Loamy coarse sand.
	C2	18 to 35	2. 2	24. 0	17. 8	19. 8	12. 8	19. 8	3. 6	Loamy coarse sand.
	C3	35 to 54	2. 7	24. 9	19. 9	19. 2	13. 1	17. 9	2. 3	Loamy coarse sand.
	C4	54 to 70+	2. 6	25. 8	21. 5	20. 9	14. 4	12. 3	2. 5	Loamy coarse sand.
	Band [1]		1. 1	16. 8	18. 8	23. 5	14. 9	12. 1	12. 8	Sandy loam.
Cocolalla silty clay loam.	Ap	0 to 5	0	. 1	. 1	. 6	1. 2	65. 3	32. 7	Silty clay loam.
	A12	5 to 13	. 1	. 2	. 2	. 5	2. 2	67. 0	29. 8	Silty clay loam.
	C1g	13 to 20	0	. 4	. 3	1. 1	5. 6	72. 4	20. 2	Silt loam.
	C2g	20 to 26	. 7	1. 7	. 9	2. 4	7. 6	71. 9	14. 8	Silt loam.
	C3g	26 to 46	. 4	. 6	. 3	2. 3	8. 4	79. 7	8. 3	Silt loam.
	IIA1b	46 to 56	. 1	. 3	. 2	. 6	3. 1	59. 8	35. 9	Silty clay loam.
	IIC1b	56 to 62+	. 4	1. 4	3. 6	18. 2	5. 9	42. 8	27. 7	Clay loam.
Freeman silt loam.	A1p	0 to 7	. 2	. 5	. 5	2. 2	6. 2	74. 2	16. 2	Silt loam.
	A21	7 to 12	. 1	. 8	. 7	2. 8	6. 4	76. 7	12. 5	Silt loam.
	A22	12 to 17	. 1	. 8	. 7	2. 8	6. 2	79. 6	9. 8	Silt loam.
	A&B	17 to 22	. 1	. 4	. 4	1. 3	4. 5	71. 4	21. 9	Silt loam.
	B21t [2]	22 to 35	. 1	. 3	. 3	. 9	3. 9	67. 0	27. 5	Silty clay loam.
	B21t [2]	35 to 49	. 1	. 4	. 4	1. 0	3. 9	65. 5	28. 7	Silty clay loam.
	B22t	49 to 59	0	. 5	. 4	. 8	4. 2	67. 4	26. 7	Silt loam.
	B23t	59 to 72	. 3	. 8	. 5	1. 0	4. 4	65. 6	27. 4	Silty clay loam.
Hesseltine silt loam.	A1	0 to 3	10. 9	5. 9	2. 6	6. 9	8. 7	55. 4	9. 6	Silt loam.
	B1	3 to 6	13. 9	5. 5	2. 3	6. 3	7. 7	52. 8	11. 5	Silt loam.
	B21t	6 to 13	10. 5	6. 2	2. 6	6. 6	7. 6	51. 7	14. 8	Silt loam.
	B22t	13 to 17	14. 0	6. 6	2. 5	6. 5	7. 2	48. 2	15. 0	Loam.
	IIC1	17 to 36	32. 4	8. 7	3. 6	7. 6	9. 0	30. 1	8. 6	Coarse sandy loam.
	IIIC2	36 to 60+	60. 0	7. 7	1. 7	3. 1	4. 0	17. 8	5. 7	Loamy coarse sand.
Spokane loam.	A1	0 to 3	15. 6	11. 9	5. 7	11. 4	9. 4	37. 3	8. 7	Coarse sandy loam.
	A3	3 to 9	16. 4	13. 1	6. 3	12. 8	9. 8	33. 1	8. 5	Coarse sandy laom.
	B2	9 to 17	19. 8	14. 5	6. 8	14. 5	9. 7	27. 9	6. 8	Coarse sandy loam.
	C1	17 to 25	13. 9	20. 1	9. 2	18. 8	11. 3	21. 1	5. 6	Coarse sandy loam.
	C2	25 to 52+	23. 8	20. 1	8. 1	15. 5	8. 9	18. 8	4. 8	Loamy coarse sand.
Springdale gravelly sandy loam.	A1	0 to 2	38. 8	14. 3	5. 8	4. 2	3. 8	27. 5	5. 6	Coarse sandy loam.
	AC	2 to 6	33. 5	16. 7	7. 2	5. 3	4. 9	26. 6	5. 8	Coarse sandy loam.
	C1	6 to 12	34. 1	17. 8	8. 4	5. 7	4. 6	23. 5	5. 9	Coarse sandy loam.
	C2	12 to 24	47. 5	21. 6	5. 6	3. 7	2. 9	13. 7	5. 0	Loamy coarse sand.
	IIC3	24 to 46+	68. 2	21. 9	2. 0	. 9	. 6	3. 8	2. 6	Coarse sand.

[1] The band is part of the C4 horizon; it is loamy sand in texture.
[2] The horizon designated B21t in the profile description was separated into two parts for this analysis.

In 1959, there were in the county 575 field-crop farms, all but 10 of which were cash-grain farms; there were 309 livestock farms, 274 dairy farms, 81 poultry farms, 30 fruit and nut farms, and 25 vegetable farms. The rest of the 2,990 farms were miscellaneous or unclassified.

Wheat is the principal crop in the county. At present the acreage of wheat is controlled by allotments established by the U.S. Department of Agriculture. The principal crops and the acreage of each are shown in table 11.

The beef cattle industry in Spokane County is largely in the southwestern part. Hereford, Shorthorn, and Angus cattle are raised for meat. Jersey, Guernsey, Holstein, Brown Swiss, and Ayrshire are the main breeds of dairy cattle. Horses are raised for handling livestock and for pleasure riding. Swine and sheep are raised to a limited extent. The poultry industry consists of the operation of commercial hatcheries and the production of eggs and fryers. The number and kinds of livestock on farms are shown in table 12.

TABLE 11.—*Acreage of principal crops*

Crops	1954	1959
	Acres	*Acres*
Winter wheat	103, 279	100, 768
Spring wheat	14, 796	7, 940
Oats	[1] 23, 020	21, 086
Barley	35, 414	41, 606
Rye	(2)	1, 899
Peas	34, 715	41, 660
Alfalfa and alfalfa mixtures for hay	55, 256	51, 622
Clover, timothy, mixtures of clover and grass, and other hay crops	11, 433	10, 524
Merion bluegrass, red fescue, and other grass seed harvested	(2)	5, 121
Tree fruits, nuts, and grapes	1, 237	1, 497
Vegetables harvested for sale	1, 187	1, 008
Berries harvested for sale	145	121

[1] Oats grown alone, threshed or combined.
[2] Not reported.

TABLE 12.—*Livestock on farms*

Livestock	1954	1959
	Number	*Number*
All cattle and calves	48, 081	45, 152
Milk cows	12, 129	10, 224
Horses and mules	2, 215	2, 492
Hogs and pigs	11, 476	13, 657
Sheep and lambs	2, 082	4, 528
Chickens, 4 months old and older	281, 103	304, 469

Climate[7]

The climate of Spokane County is comparatively mild and dry for the latitude. It is influenced by the Cascade and Rocky Mountain ranges. The Rockies shield this area from the more severe winter storms that move southward across Canada, and the Cascades form a barrier to the easterly flow of moist air from the Pacific Ocean. But some of the air from each of these sources reaches Spokane County, and thus the climate has some characteristics of a continental climate and some of a marine climate.

Table 13 shows the probability of freezing temperatures after specified dates in spring and before specified dates in fall. Tables 14, 15, and 16 show temperature and precipitation data at the Spokane International Airport, at Cheney, and at Deer Park.

The summers are warm, dry, and sunny. In the warmest months the afternoon temperature normally ranges from 80 to 90 degrees, and the nighttime temperature from 45 to 55 degrees. The maximum temperature is more than 90 degrees on 15 to 20 days each summer and occasionally 100 degrees or slightly higher. Extremely high temperatures are generally associated with a northward movement of hot, dry air from the southwestern desert regions; the relative humidity is very low under these conditions. The average relative humidity in the summer is about 60 percent at 4 a.m. and 30 percent at 4 p.m. A flow of cooler marine air from the ocean usually follows a few exceptionally hot days. The maximum temperatures throughout the county differ little, except for a decrease in temperature with an increase in elevation along the slopes of Mount Spokane.

TABLE 13.—*Probability of freezing temperatures after specified dates in spring and before specified dates in fall*

Station	Temperature	Probability in spring					Probability in fall					Period between last occurrence in spring and first in fall
		90 percent	75 percent	50 percent	25 percent	10 percent	10 percent	25 percent	50 percent	75 percent	90 percent	
	°F											*Days*
Cheney.	32	Apr. 24	May 6	May 20	June 3	June 14	Sept. 2	Sept. 13	Sept. 25	Oct. 7	Oct. 18	128
	28	Apr. 3	Apr. 15	Apr. 29	May 12	May 25	Sept. 21	Oct. 2	Oct. 15	Oct. 27	Nov. 7	169
	24	Mar. 7	Mar. 20	Apr. 2	Apr. 15	Apr. 29	Oct. 5	Oct. 16	Oct. 28	Nov. 9	Nov. 20	209
	20	Feb. 19	Mar. 3	Mar. 16	Mar. 29	Apr. 10	Oct. 20	Oct. 31	Nov. 12	Nov. 24	Dec. 5	241
	16	Feb. 2	Feb. 14	Feb. 28	Mar. 13	Mar. 25	Nov. 3	Nov. 13	Nov. 26	Dec. 9	Dec. 23	271
Deer Park.	32	May 10	May 23	June 5	June 19	June 30	July 30	Aug. 10	Aug. 22	Sept. 3	Sept. 14	78
	28	Apr. 24	May 5	May 19	May 31	June 13	Aug. 28	Sept. 8	Sept. 20	Oct. 2	Oct. 13	124
	24	Mar. 25	Apr. 7	Apr. 20	May 3	May 16	Sept. 15	Sept. 26	Oct. 8	Oct. 20	Oct. 31	171
	20	Mar. 4	Mar. 16	Mar. 29	Apr. 11	Apr. 23	Oct. 2	Oct. 13	Oct. 25	Nov. 6	Nov. 17	210
	16	Feb. 15	Feb. 28	Mar. 13	Mar. 27	Apr. 7	Oct. 24	Nov. 4	Nov. 16	Nov. 28	Dec. 9	248
Spokane International Airport.	32	Mar. 25	Apr. 7	Apr. 20	May 4	May 15	Sept. 19	Sept. 30	Oct. 12	Oct. 24	Nov. 4	175
	28	Mar. 11	Mar. 24	Apr. 6	Apr. 19	May 1	Oct. 3	Oct. 14	Oct. 26	Nov. 7	Nov. 18	203
	24	Feb. 16	Feb. 28	Mar. 14	Mar. 27	Apr. 8	Oct. 18	Oct. 29	Nov. 10	Nov. 22	Dec. 3	241
	20	Jan. 19	Feb. 7	Feb. 21	Mar. 7	Mar. 19	Oct. 31	Nov. 11	Nov. 23	Dec. 6	Dec. 18	275
	16	(1)	Jan. 26	Feb. 11	Feb. 26	Mar. 10	Nov. 13	Nov. 24	Dec. 8	Dec. 26	(1)	300

[1] Not reported.

[7] By EARL PHILLIPS, State climatologist, U.S. Weather Bureau, Seattle, Washington.

TABLE 14.—*Temperature and precipitation*

Elevation

Month	Temperature [1]				Precipitation [2]		
	Average daily maximum [3]	Average daily minimum [3]	2 years in 10 will have at least 4 days with—		Average [3]	1 year in 10 will have [4]—	
			Maximum equal to or higher than—	Minimum equal to or lower than—		Less than—	More than—
	°F.	°F.	°F.	°F.	Inches	Inches	Inches
January	31.4	19.2	47	6	2.44	1.0	3.5
February	37.4	22.5	49	12	1.86	.3	2.8
March	47.0	29.1	61	20	1.50	.5	2.5
April	58.6	35.9	75	27	.91	.3	1.7
May	68.3	43.1	85	35	1.21	.2	3.2
June	73.5	49.3	88	43	1.49	.3	2.8
July	83.6	55.4	96	47	.38	(5)	1.3
August	81.0	53.9	95	46	.41	(5)	1.8
September	72.7	47.0	89	37	.75	.1	1.9
October	59.1	38.0	75	28	1.57	.3	2.8
November	41.9	28.5	54	16	2.24	.6	3.7
December	34.9	24.2	48	12	2.43	.9	3.7
Annual	57.6	37.2	(6)	(6)	17.19	11.1	19.8

[1] Highest temperature on record, 108°; lowest temperature on record, −30°.

[2] Total precipitation for wettest year, 26.07 inches; total precipitation for driest year, 7.54 inches.

TABLE 15.—*Temperature and*

Elevation

Month	Temperature [1]				Precipitation [2]		
	Average daily maximum [3]	Average daily minimum [3]	2 years in 10 will have at least 4 days with—		Average [3]	1 year in 10 will have [4]—	
			Maximum equal to or higher than—	Minimum equal to or lower than—		Less than—	More than—
	°F.	°F.	°F.	°F.	Inches	Inches	Inches
January	33	20	48	−2	2.27	.5	3.2
February	40	24	52	9	2.00	.7	3.0
March	48	28	65	17	1.70	.3	2.8
April	60	35	78	24	1.28	.4	2.2
May	68	42	84	29	1.54	.4	3.5
June	74	47	89	36	1.75	.2	3.4
July	85	52	98	42	.48	0	1.8
August	84	51	95	38	.50	0	1.6
September	75	46	90	33	1.17	.1	2.1
October	60	37	77	21	1.81	.3	3.6
November	44	29	62	17	2.21	.7	3.8
December	36	24	49	10	2.61	1.0	3.7
Annual	58	36	(6)	(6)	19.32	13.8	24.1

[1] Highest temperature on record, 107°; lowest temperature on record, −35°

[2] Total precipitation for the wettest year, 31.31 inches; total precipitation for driest year, 12.15 inches.

at Spokane International Airport
2,357 feet]

Precipitation [2]—Continued									
2 years in 10 will have [4]—		3 years in 10 will have [4]—		4 years in 10 will have [4]—		Average snowfall	Maximum depth of snow on ground	Average number of days with snow cover	Average depth of snow on days with snow cover
Less than—	More than—	Less than—	More than—	Less than—	More than—				
Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*		*Inches*
1.2	2.4	1.3	2.2	1.5	2.0	21	27	18	6
.8	2.0	1.1	1.7	1.3	1.6	10	29	16	5
.7	1.8	.8	1.5	1.0	1.2	5	9	4	2
.4	1.5	.5	1.3	.8	1.1	(5)	4	−1	1
.5	2.2	.6	1.6	.7	1.3	(5)	0	0	0
.4	2.0	.7	1.2	.8	1.0	0	0	0	0
(5)	.8	.1	.7	.2	.5	0	0	0	0
.1	1.2	.2	.9	.3	.6	0	0	0	0
.2	1.4	.4	1.0	.5	.7	(5)	1	−1	1
.4	1.9	.7	1.4	.8	1.1	1	4	−1	3
.9	2.7	1.2	2.6	1.6	2.4	6	13	3	2
1.4	2.8	1.5	2.3	1.6	1.9	15	25	11	3
12.0	18.2	12.9	17.4	13.9	16.3	58	29	52	(6)

[3] Normals for period 1931 to 1960.
[4] Period of record 1901 to 1960.
[5] Trace.
[6] Not reported.

precipitation at Cheney
2,400 feet]

Precipitation [2]—Continued									
2 years in 10 will have [4]—		3 years in 10 will have [4]—		4 years in 10 will have [4]—		Average snowfall	Maximum depth of snow on ground	Average number of days with snow cover	Average depth of snow on days with snow cover
Less than—	More than—	Less than—	More than—	Less than—	More than—				
Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*		*Inches*
.8	3.0	1.6	2.5	1.8	2.0	14	21	16	4
.8	2.5	1.1	2.2	1.5	2.0	9	26	14	4
.5	2.5	.8	2.3	1.0	1.4	3	7	3	1
.5	1.6	.7	1.4	.9	1.2	(5)	2	−1	0
.7	3.2	.8	2.1	1.2	1.7	(5)	0	0	0
.4	2.1	.6	1.6	1.0	1.3	0	0	0	0
(5)	1.7	.1	.5	.1	.4	0	0	0	0
(5)	.8	(5)	.4	.1	.3	0	0	0	0
.3	1.7	.4	1.5	.7	1.1	0	0	0	0
.6	3.3	.7	1.8	.9	1.5	(5)	3	−1	0
.9	3.5	1.3	3.1	1.9	2.5	4	6	5	2
1.1	3.5	1.8	3.1	2.0	2.5	14	20	13	3
14.1	20.9	15.4	19.2	17.9	18.4	44	(6)	51	(6)

[3] Averages for period 1938 to 1955.
[4] Period of record 1901 to 1911 and 1938 to 1955.
[5] Trace
[6] Not reported

TABLE 16.—*Temperature and*
[Elevation

Month	Temperature[1]				Precipitation[2]		
	Average daily maximum[3]	Average daily minimum[3]	2 years in 10 will have at least 4 days with— Maximum equal to or higher than—	2 years in 10 will have at least 4 days with— Minimum equal to or lower than—	Average[3]	1 year in 10 will have[4]— Less than—	1 year in 10 will have[4]— More than—
	°F.	°F.	°F.	°F.	Inches	Inches	Inches
January	32	16	45	−10	2. 90	1. 0	4. 6
February	38	19	49	−4	2. 11	. 8	3. 9
March	47	25	61	13	1. 86	. 6	2. 9
April	60	32	74	21	1. 53	. 4	3. 3
May	69	39	84	28	1. 67	. 4	3 8
June	75	44	87	34	1. 52	. 5	2. 7
July	85	46	96	35	. 47	(5)	1. 2
August	83	44	95	34	. 58	(5)	2. 0
September	74	39	89	29	1. 18	. 2	2. 7
October	60	32	75	21	2. 22	. 4	4. 0
November	42	25	55	9	2. 75	. 7	4. 6
December	35	22	45	3	3. 24	1. 3	5. 4
Annual	58	32	(6)	(6)	22. 03	15. 5	26. 9

[1] Highest temperature on record, 107°; lowest temperature on record, −42°.

[2] Total precipitation for wettest year, 30.42 inches; total precipitation for driest year, 11.87 inches.

Because the county is near the general path of "highs" and "lows" moving eastward from the Pacific or southward across western Canada, there are frequent changes in the winter weather. Cold snaps are not infrequent, but cold spells of any length are the exception. In the coldest months the average maximum temperature is near freezing and the minimum temperature ranges from 15 to 25 degrees. During a typical winter, minimum temperatures of zero or lower are recorded on 10 to 15 days. In a few of the colder winters, minimum temperatures have dropped to −10 degrees on 15 to 20 days, −20 degrees on 5 to 10 days, and −30 degrees or lower on a few days. The coldest weather generally occurs when cold arctic air, moving southward across Canada, spills over the Rockies and enters the inland basin. Clear skies usually accompany these cold outbreaks; consequently, additional heat is lost through nighttime radiation. Then an easterly flow of warmer, moist air from the ocean brings relief from low temperatures within a few days. The mixing of the warmer moist air with the colder air in the basin results in considerable cloudiness, fog, and some freezing drizzle. In midwinter, the average relative humidity is 85 percent at 4 a.m. and 75 percent at 4 p.m. The cloud cover reduces the loss of heat through radiation at night. Consequently, temperatures are milder than might be expected at this latitude. The northern section of the county is the coldest, and the Spokane Valley is the warmest.

The average annual precipitation ranges from 15 to 23 inches in the agricultural areas and from 40 to 50 inches along the timber-covered slopes and near the summit of Mount Spokane. In general, precipitation increases in an easterly direction across the county. Precipitation is very light in the summer, gradually increases in the fall, and reaches a peak of 2 or 3 inches each month in midwinter; then it decreases in the spring, increases slightly in May and June, and drops sharply in July. Most of the winter precipitation is snow. During an average winter, snow accumulates to a depth of 10 to 18 inches at the lower elevations and remains on the ground most of the time from the first half of December until the latter half of February. In a few winters snow has reached a depth of 30 to 40 inches in some of the agricultural areas and 150 inches or more on the higher slopes of Mount Spokane. The higher parts of Mount Spokane are usually covered with snow from the first of November until after the first of May.

A warm chinook wind or a rain sometimes melts a snow cover very rapidly, and if the ground is frozen, much of the moisture may be lost as runoff. The depth of frost in the soil varies from year to year and is influenced by the snow cover and temperature. In a typical winter, frost penetrates to a depth of 12 to 18 inches. If several inches of snow accumulates before any unusually cold weather, frost penetration is very shallow, but in a few winters of light snowfall and cold temperatures, frost has penetrated to a depth of 30 inches.

Summer precipitation is frequently associated with thunderstorm activity, which begins about May, reaches a peak of 5 to 10 thunderstorms each month in midsummer, and ends in the early fall. Brief periods of hail or intense rainfall sometimes accompany thunderstorms. Destructive hailstorms have occurred. The maximum amounts of rainfall recorded in brief periods of time at Spokane are as follows: In 5 minutes, 0.45 of an inch; in 10 minutes, 0.72 of an inch; in 15 minutes, 0.81 of an inch and in 60 minutes, 1.02 inches. Records at the Spokane weather station indicate that a rainfall of 0.3 inch in 1 hour can be expected every 2 years; 0.5 inch in 1 hour every 5 years; and 0.7 inch in 1 hour every 25 years. In the driest part of the summer, thunderstorms are sometimes accompanied

precipitation at Deer Park

2,114 feet]

Precipitation [2]—Continued										
2 years in 10 will have [4]—		3 years in 10 will have [4]—		4 years in 10 will have [4]—		Average snowfall	Maximum depth of snow on ground	Average number of days with snow cover	Average depth of snow on days with snow cover
Less than—	More than—	Less than—	More than—	Less than—	More than —				
Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*		*Inches*
1. 5	3. 8	2. 0	3. 4	2. 4	3. 0	15. 7	30	25	7
1. 1	2. 7	1. 3	2. 5	1. 6	2. 2	12. 7	32	18	9
. 8	2. 5	1. 0	2. 1	1. 3	1. 9	2. 3	22	8	6
. 6	2. 1	. 9	1. 9	1. 1	1. 7	. 3	5	0	0
. 5	2. 6	. 7	1. 6	. 9	1. 3	(5)	0	0	0
. 6	2. 1	. 9	1. 8	1. 1	1. 5	0	0	0	0
. 1	1. 0	. 1	. 7	. 2	5	0	0	0	0
. 1	1. 3	. 2	1. 1	. 3	. 7	0	0	0	0
. 4	2. 0	. 5	1. 3	. 8	1. 0	0	0	0	0
. 8	2. 5	1. 1	2. 2	1. 2	1. 9	. 6	2	2	2
1. 5	4. 1	1. 8	3. 5	2. 2	2. 9	4. 5	8	5	2
1. 9	3. 8	2. 2	3. 5	2. 6	2. 9	14. 1	24	18	4
17. 5	25. 5	19. 1	23. 0	20. 1	21. 6	50. 2	(6)	76	(6)

[3] Normals for period 1931 to 1960.
[4] Period of record 1912 to 1960.
[5] Trace.
[6] Not reported.

by very little or no precipitation and many forest and range fires are started by lightning.

The number of days each month with 0.01 inch of precipitation increases from less than 5 in July and August to nearly 20 in December and January. One inch or more of precipitation in 24 hours can be expected on 18 to 20 days each year and 0.01 inch or more on 115 to 120 days.

The number of cloudy days each month ranges from 20 to 25 in midwinter, then decreases to 12 to 15 in the spring and fall, and to about 5 in midsummer. The percentage of possible sunshine increases from about 25 percent in the winter to 60 percent in the spring and to 80 percent in the summer. The number of hours of sunshine possible each day ranges from approximately 8 in December to 16 in June. The prevailing direction of the wind is southwest in the summer and northeast in the winter. The mean monthly speed recorded at Geiger Field near Spokane ranges from 7.4 miles per hour in October to 9.2 miles per hour in March. The strongest winds throughout the year are from the southwest or west. The strongest wind that has been recorded at Geiger Field was 56 miles per hour; it was from the southwest.

Transportation, Markets, and Industries

Spokane County is an important railroad terminus and distribution point, it has an excellent network of highways, and it is served by national, international, and feeder airlines. The county has nearly 350 miles of railroad tracks. The highways include U.S. Routes 2, 10, 195, and 395. The extensive county road system serves all of the county except some of the remote mountainous areas in the northeast.

The city of Spokane is an industrial center for agricultural, lumbering, and mining enterprises. It is a good market for fruit, potatoes, and all truck crops. Dairy products are sold locally. Wheat and other small grains, in excess of local needs, are shipped to other places. Poultry products, cattle, hogs, and sheep are marketed locally or shipped to surrounding cities and towns. Timber is processed and sold locally or shipped to outlying areas.

This area has become one of the Nation's leading sources of pig aluminum and manufactured aluminum.

In addition to the processing of meat, dairy, and poultry products, important industries include the manufacture of lumber and wood products, machinery and metal products, clay and cement products, electronic products, and petroleum products.

Wildlife [8]

The wildlife population of Spokane County formerly included elk, deer, bear, cougar, coyotes, beaver, wolves, muskrat, mink, snowshoe rabbit, cottontail rabbit, waterfowl, grouse, and sage hens.

At present deer and coyotes are scattered throughout the county but are most numerous in the mountainous foothills and channeled scabland. There are no elk or wolves in the county now. Bear, cougar, snowshoe rabbit, and grouse are confined to the timbered areas. Beaver, muskrat, mink, and waterfowl live along streams and lakes and in fresh-water marshes throughout the county.

Ring-necked pheasants, Hungarian partridges, and California quail have been introduced. These birds are most abundant in the cultivated areas. They have adapted themselves to brushy draws, weed patches, and other idle areas near water. Sage hens are found in the

[8] JERRY THOLA, assistant area conservationist, Soil Conservation Service, assisted with this section.

county, but are few in number. Ducks, geese, and cottontail rabbits are plentiful in the southwestern part of the county. The many lakes, potholes, and fresh-water marshes are ideal nesting and feeding grounds for waterfowl.

The Turnbull National Wildlife Refuge near Cheney was created by Executive Order, July 30, 1937. This refuge, which comprises 14,530 acres, has been set aside for protection and breeding of waterfowl.

More than a dozen well-stocked lakes in the county provide excellent fishing. Trout, perch, crappies, sunfish, and bass are the main species. Trash fish have been eliminated from many lakes, and the lakes have been restocked with trout. The perennial streams in the county are stocked and provide good fishing.

Hunting and fishing are well regulated by State and Federal laws.

Literature Cited

(1) American Association of State Highway Officials.
1961. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., illus.

(2) Fryxell, Roald.
1965. MAZAMA AND GLACIER PEAK VOLCANIC ASH LAYERS; RELATIVE AGES. Science, v. 147, No. 3663, pp. 1288–1290, Mar. 12, 1965.

(3) Haig, Irving T.
1932. SECOND-GROWTH YIELD, STAND, AND VOLUME TABLES FOR THE WESTERN WHITE PINE TYPE. U.S. Dept. Agr. Tech. Bul. 323, 68 pp., illus.

(4) Kilmer, V. J., and Alexander, L. T.
1949. METHODS OF MAKING MECHANICAL ANALYSES OF SOILS. Soil Sci. 68: 15–24.

(5) ——— and Mullins, J. F.
1954. IMPROVED STIRRING AND PIPETTING APPARATUS FOR MECHANICAL ANALYSIS OF SOILS. Soil Sci. 77: 437–441.

(6) Meyer, Walter H.
1938. YIELD OF EVEN-AGED STANDS OF PONDEROSA PINE. U.S. Dept. Agr. Tech. Bul. 630, 60 pp., illus.

(7) Olmstead, L. B., Alexander, L. T., and Middleton, H. E.
1930. A PIPETTE METHOD OF MECHANICAL ANALYSIS OF SOILS BASED ON IMPROVED DISPERSION PROCEDURE. U.S. Dept. Agr. Tech. Bul. 170, 22 pp., illus.

(8) Peech, M., Alexander, L. T., and Others.
1947. METHODS OF SOIL ANALYSIS FOR SOIL-FERTILITY INVESTIGATIONS. U.S. Dept. Agr. Circ. 757, 23 pp.

(9) Society of American Foresters.
1954. FOREST COVER TYPES OF NORTH AMERICA. 67 pp. Wash., D.C.

(10) U.S. Department of Agriculture.
1951. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handbk. 18, 503 pp., illus.

(11) ———
1958. SOIL AND WATER CONSERVATION NEEDS—A NATIONAL INVENTORY. Misc. pub. 971, 94 pp.

(12) Waterways Experiment Station, Corps of Engineers.
1953. THE UNIFIED SOIL CLASSIFICATION SYSTEM. Tech. Memo. 3–357, 2 v., Vicksburg, Miss.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Bottom land. Low land formed by alluvial deposits along a stream or in a lake basin; a flood plain.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour tillage. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Drainage, soil. The relative rapidity and extent of removal of water from the surface and from within the soil under natural conditions. Terms commonly used to describe drainage are:

Very poorly drained.—Water is removed so slowly that the soil remains wet most of the time, water ponds on the surface frequently, and the water table is at the surface most of the time.

Poorly drained.—Water is removed so slowly that the soil remains wet a large part of the time and the water table is at or near the surface during a considerable part of the year.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods but not all of the time.

Moderately well drained.—Water is removed somewhat slowly, and the soil is wet for a small but significant part of the time.

Well drained.—Water is removed readily but not rapidly. A well-drained soil has good drainage.

Somewhat excessively drained.—Water is removed so rapidly that only a small amount of it is available to plants. Only a few kinds of crops can be grown, and yields are usually low unless the soil is irrigated.

Excessively drained.—Water is removed very rapidly. Enough is lost that the soil is unsuitable for ordinary crops.

Fertility. The quality that enables a soil to provide the proper compounds in adequate amounts and in proper balance for the growth of specified plants when light, moisture, temperature, physical condition (tilth) of the soil and other factors are favorable. Terms used in this report are relative and apply only in relation to other soils in Spokane County. The terms are *very low, low, medium,* and *high.*

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented when dry, has a hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt-water as it flowed from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Gravel. Rounded and subrounded fragments of rocks up to 3 inches in diameter. Also refers to a mass of fragments.

Green-manure crop. Any crop grown and plowed under while green for the purpose of improving the soil.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. Horizons are identified by letters of the alphabet.

Inclusions. Areas of soil mapped with a different soil because they were too small to be mapped separately on a map at the scale used. Such areas can amount to as much as 15 percent of any area mapped.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters in diameter along the greatest dimension.

Muck. See Organic soil.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter. If the organic matter is undecomposed and can be identified, the soil is peat. If the organic matter is decomposed, the soil is muck. Muck and peat accumulate under impaired drainage.

Parent material (soil). The mass of weathered rock or partly weathered material from which the soil forms; horizon C in the soil profile.

Peat. See Organic soil.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Perched water table. A layer of saturation in the soil, separated from and held above the true ground water table by a layer of impervious material.

Permeability. The quality of a soil horizon that enables water and air to move through it. Rates of permeability are expressed in inches of water per hour. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or sour, soil is one that is acid in reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderatey alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Runoff. The water that is removed by flow over the surface of the soil. The rapidity of runoff and the amount of water removed are affected by slope; by texture, structure, and porosity of the surface soil; by vegetative covering; and by prevailing climate. Relative degrees of runoff are as follows:

Ponded.—None of the water added to the soil as precipitation or by flow from surrounding higher land escapes as runoff. Removal is by movement through the soil or by evaporation.

Very slow.—Surface water flows away so slowly that free water lies on the surface for long periods or enters immediately into the soil. Very little of the water is removed by runoff.

Slow.—Surface water flows away so slowly that free water covers the soil for significant periods or enters the soil so rapidly that only a small amount is removed as runoff. Normally, there is little or no erosion hazard.

Medium.—Surface water flows away at such a rate that a moderate proportion of the water enters the soil profile, and free water lies on the surface for only short periods. The loss of water over the surface does not reduce seriously the supply available for plant growth. This commonly is considered good external drainage. The erosion hazard is commonly moderate if soil of this class is cultivated.

Rapid.—A large proportion of the precipitation moves rapidly over the soil and a small part moves through the soil profile. The erosion hazard commonly is moderate to severe.

Very rapid.—A very large part of the water moves rapidly over the surface of the soil and a very small part goes through the profile. The erosion hazard is commonly severe or very severe.

Sand. As a soil separate, individual rock or mineral fragments having diameters that range from 0.05 to 2.0 millimeters. Most sand grains are quartz, but sand may be of any mineral composition. As a textural class, any soil that is 85 percent sand and not more than 10 percent clay.

Saline-alkali soil. A soil having a combination of a harmful quantity of salts and either a high alkalinity or a high exchangeable sodium, or both, so distributed in the soil profile that the growth of most crop plants is reduced.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of soil particles into lumps, granules, or other aggregates. Structure is described by grade (weak, moderate, or strong), the distinctness and durability of the aggregates; by size (very fine, fine, medium, coarse, or very coarse); and by shape (platy, prismatic, columnar, blocky, granular, or crumb). A soil is structureless if there are no observable aggregates. A structureless soil is single grain (noncoherent—each grain by itself, as in dune sand) or massive (coherent—the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C horizon.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Volcanic ash. Small, ash-like particles of solid or porous obsidian or pumice ejected in volcanic activity.

Water-holding capacity. The capacity of the soil to take in and hold a supply of moisture in amounts favorable to most crop plants. It reflects slope, infiltration capacity, moisture retentiveness, rainfall, and depth of soil.

GUIDE TO MAPPING UNITS

[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

[An asterisk indicates components of mapping unit have separate interpretive groupings; see mapping unit description for groupings. Dashes indicate mapping unit is not used for purpose specified. See table 1, p. 6, for acreage and proportionate extent of soils; table 2, p. 54, for estimated yields of principal crops; tables 6 and 7, pp. 68 and 86, for engineering properties of soils]

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland group Number	Woodland group Page	Range site Name	Range site Page
AaA	Athena silt loam, 0 to 5 percent slopes	8	IIe-1	41	--	--	Loamy	59
AaC	Athena silt loam, 5 to 30 percent slopes	8	IIIe-1	44	--	--	Loamy	59
AaD	Athena silt loam, 30 to 55 percent slopes	8	*IVe-1	49	--	--	*	--
AaE	Athena silt loam, 55 to 70 percent slopes	8	VIIe-1	52	--	--	North Exposure	59
AlC	Athena-Lance silt loam, 0 to 30 percent slopes	8	*IVe-1	49	--	--	*	--
AlD	Athena-Lance silt loam, 30 to 55 percent slopes	8	*VIe-1	52	--	--	*	--
BaB	Bernhill silt loam, 0 to 20 percent slopes	9	IIIe-2	44	4	63	-----	--
BaC	Bernhill silt loam, 20 to 30 percent slopes	9	IIIe-2	44	4	63	-----	--
BaD	Bernhill silt loam, 30 to 55 percent slopes	9	VIe-2	52	4	63	-----	--
BbB	Bernhill silt loam, moderately shallow, 0 to 20 percent slopes	9	IIIe-4	46	8	64	-----	--
BbD	Bernhill silt loam, moderately shallow, 30 to 55 percent slopes	9	VIe-2	52	8	64	-----	--
BeB	Bernhill gravelly silt loam, 0 to 20 percent slopes	9	IIIe-4	46	8	64	-----	--
BfB	Bernhill very stony silt loam, 0 to 20 percent slopes	9	VIs-1	52	8	64	-----	--
BfD	Bernhill very stony silt loam, 20 to 55 percent slopes	9	VIIs-1	52	8	64	-----	--
BhD	Bernhill soils, 20 to 55 percent slopes	9	*VIe-2	52	8	64	-----	--
BkC	Bernhill very rocky complex, 0 to 30 percent slopes	9	*VIs-1	52	*	--	-----	--
BkD	Bernhill very rocky complex, 30 to 55 percent slopes	10	*VIIs-1	52	*	--	-----	--
BoB	Bong coarse sandy loam, 0 to 8 percent slopes	10	IVe-5	50	--	--	Shallow	59
BpB	Bong and Phoebe fine sandy loams, 0 to 8 percent slopes	10	IIIe-6	47	--	--	Loamy	59
BrB	Bong and Phoebe coarse sandy loams, 0 to 20 percent slopes	10	IIIe-6	47	--	--	Shallow	59
BrC	Bong and Phoebe coarse sandy loams, 20 to 30 percent slopes	10	VIe-1	52	--	--	Shallow	59
BsB	Bong and Phoebe loamy sands, 0 to 20 percent slopes	10	IIIe-5	46	--	--	Shallow	59
BtB	Bonner silt loam, 0 to 8 percent slopes	11	IVe-6	50	11	65	-----	--
BuB	Bonner gravelly silt loam, 0 to 20 percent slopes	11	VIe-2	52	13	65	-----	--
BvB	Bonner loam, 0 to 20 percent slopes	11	IVe-6	50	11	65	-----	--
BwB	Bonner fine sandy loam, 0 to 20 percent slopes	11	IVe-6	50	13	65	-----	--
BxD	Brickel stony loam, 20 to 55 percent slopes	11	VIs-2	52	--	--	-----	--
By	Bridgeson silt loam	12	IVw-1	51	--	--	Wet Meadow	59
Bz	Bridgeson silt loam, drained	12	IIIw-2	48	--	--	-----	--
Ca	Caldwell silt loam	12	IIw-1	44	--	--	Bottomland	58
CeA	Cedonia silt loam, 0 to 5 percent slopes	12	IIe-2	42	3	63	-----	--
CeB	Cedonia silt loam, 5 to 20 percent slopes	13	IIIe-2	44	3	63	-----	--
CeC3	Cedonia silt loam, 20 to 30 percent slopes, severely eroded	13	IVe-3	49	3	63	-----	--

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Range site	
			Symbol	Page	Number	Page	Name	Page
CgB	Cheney gravelly silt loam, 0 to 8 percent slopes	13	IVe-5	50	--	--	Shallow	59
ChB	Cheney stony silt loam, 0 to 20 percent slopes	13	VIs-2	52	--	--	Shallow	59
CkC	Cheney very rocky complex, 0 to 30 percent slopes	13	*VIIs-2	52	--	--	*	--
CmC	Cheney extremely rocky complex, 0 to 30 percent slopes	13	*VIIs-2	52	--	--	*	--
CnB	Cheney and Uhlig silt loams, 0 to 8 percent slopes	13	*IIIe-6	47	--	--	*	--
CoB	Cheney-Uhlig complex, 0 to 8 percent slopes	14	VIs-2	52	--	--	Shallow	59
CsA	Clayton fine sandy loam, 0 to 5 percent slopes	14	IIe-6	43	3	63	-----	--
CsB	Clayton fine sandy loam, 5 to 20 percent slopes	14	IIIe-5	46	3	63	-----	--
CtA	Clayton loam, 0 to 5 percent slopes	14	IIe-6	43	3	63	-----	--
CtB	Clayton loam, 5 to 20 percent slopes	14	IIIe-5	46	3	63	-----	--
CuB	Clayton sandy loam, 0 to 8 percent slopes	14	IVe-5	50	15	66	-----	--
Cw	Cocolalla silty clay loam	15	Vw-1	52	--	--	Wet Meadow	59
Cy	Cocolalla silty clay loam, drained	15	IVw-2	51	--	--	Wet Meadow	59
DaA	Dearyton silt loam, 0 to 5 percent slopes	16	IIw-2	44	5	63	-----	--
DaB	Dearyton silt loam, 5 to 20 percent slopes	16	IIIe-3	45	5	63	-----	--
DaC	Dearyton silt loam, 20 to 40 percent slopes	16	IVe-2	49	5	63	-----	--
DeB	Dearyton silt loam, thin solum variant, 0 to 20 percent slopes	16	IIIe-3	45	16	66	-----	--
DrC	Dragoon silt loam, 0 to 30 percent slopes	16	IIIe-1	44	8	64	-----	--
DsC	Dragoon stony silt loam, 0 to 30 percent slopes	16	VIs-1	52	8	64	-----	--
DsD	Dragoon stony silt loam, 30 to 55 percent slopes	17	VIs-1	52	8	64	-----	--
DvD	Dragoon very rocky complex, 20 to 55 percent slopes	17	*VIIs-2	52	*	--	-----	--
EkB	Eloika silt loam, 0 to 20 percent slopes	17	IIIe-5	46	12	65	-----	--
ElC	Eloika very stony silt loam, 0 to 30 percent slopes	17	VIs-1	52	12	65	-----	--
ElD	Eloika very stony silt loam, 30 to 55 percent slopes	17	VIIs-1	52	12	65	-----	--
Em	Emdent silt loam	17	IVw-3	51	--	--	Alkali	58
FaB	Freeman silt loam, 5 to 20 percent slopes	18	IIIe-3	45	5	63	-----	--
FaB3	Freeman silt loam, 5 to 20 percent slopes, severely eroded	18	IVe-3	49	5	63	-----	--
FaC3	Freeman silt loam, 20 to 30 percent slopes, severely eroded	18	IVe-3	49	5	63	-----	--
Fm	Fresh water marsh	18	VIIIw-1	52	--	--	-----	--
GaC3	Garfield silty clay loam, 0 to 30 percent slopes, severely eroded	18	IVe-3	49	--	--	-----	--
GgA	Garrison gravelly loam, 0 to 5 percent slopes	18	IIIs-2	47	--	--	Loamy	59
GgB	Garrison gravelly loam, 5 to 20 percent slopes	19	IVe-5	50	--	--	Loamy	59
GmB	Garrison very gravelly loam, 0 to 8 percent slopes	19	IVe-5	50	--	--	Shallow	59
GnB	Garrison very stony loam, 0 to 20 percent slopes	19	VIs-2	52	--	--	Shallow	59
GpA	Glenrose silt loam, 0 to 5 percent slopes	19	IIe-2	42	--	--	Loamy	59
GpB	Glenrose silt loam, 5 to 20 percent slopes	19	IIIe-2	44	--	--	Loamy	59
GpC	Glenrose silt loam, 20 to 30 percent slopes	19	IIIe-2	44	--	--	Loamy	59

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Range site	
			Symbol	Page	Number	Page	Name	Page
GpD	Glenrose silt loam, 30 to 55 percent slopes	19	VIe-1	52	--	--	North Exposure	59
GrB	Glenrose gravelly silt loam, 5 to 20 percent slopes	19	IVe-4	50	--	--	Loamy	59
GrD	Glenrose gravelly silt loam, 20 to 55 percent slopes	19	VIe-1	52	--	--	North Exposure	59
GsD	Glenrose stony silt loam, 20 to 55 percent slopes	20	VIs-2	52	--	--	North Exposure	59
GtA	Green Bluff silt loam, 0 to 5 percent slopes	20	IIe-2	42	3	63	-----	--
GtB	Green Bluff silt loam, 5 to 20 percent slopes	20	IIIe-2	44	3	63	-----	--
HfC	Hagen loamy fine sand, 0 to 30 percent slopes	20	VIs-1	52	11	65	-----	--
HgB	Hagen sandy loam, 0 to 20 percent slopes	20	IVe-6	50	9	64	-----	--
HhA	Hardesty silt loam, 0 to 5 percent slopes	21	IIIs-1	47	10	65	-----	--
HmA	Hardesty silt loam, moderately shallow, 0 to 5 percent slopes	21	IIIs-1	47	10	65	-----	--
HnB	Hesseltine silt loam, 0 to 10 percent slopes	21	IVe-5	50	16	66	-----	--
HoB	Hesseltine silt loam, moderately deep, 0 to 8 percent slopes	21	IIIe-6	47	16	66	-----	--
HrB	Hesseltine gravelly silt loam, 0 to 10 percent slopes	21	IVe-5	50	16	66	-----	--
HsB	Hesseltine stony silt loam, 0 to 20 percent slopes	21	VIs-1	52	16	66	-----	--
HtB	Hesseltine stony silt loam, mounded, 0 to 8 percent slopes	22	VIs-1	52	16	66	-----	--
HvC	Hesseltine very rocky complex, 0 to 30 percent slopes	22	*VIIs-2	52	*	--	-----	--
HvD	Hesseltine very rocky complex, 30 to 55 percent slopes	22	*VIIs-2	52	*	--	-----	--
HxC	Hesseltine extremely rocky complex, 0 to 30 percent slopes	22	*VIIs-2	52	*	--	-----	--
Kc	Konner silty clay loam	23	IVw-1	51	--	--	Wet Meadow	59
Kd	Konner silty clay loam, drained	24	IIIw-2	48	--	--	-----	--
LaB	Lakesol silt loam, 0 to 20 percent slopes	24	IIIe-1	44	3	63	-----	--
LaD	Lakesol silt loam, 20 to 55 percent slopes	24	VIe-2	52	3	63	-----	--
LeA	Laketon silt loam, 0 to 5 percent slopes	24	IIe-6	43	3	63	-----	--
LeB	Laketon silt loam, 5 to 20 percent slopes	24	IIIe-5	46	3	63	-----	--
LfA	Laketon fine sandy loam, 0 to 5 percent slopes	24	IIe-6	43	3	63	-----	--
LmC	Lance silt loam, 0 to 30 percent slopes	25	IIIe-1	44	--	--	Loamy	59
LmC3	Lance silt loam, 0 to 30 percent slopes, severely eroded	24	IVe-7	51	--	--	-----	--
LnA2	Larkin silt loam, 0 to 5 percent slopes, eroded	25	IIe-3	42	5	63	-----	--
LnB2	Larkin silt loam, 5 to 20 percent slopes, eroded	25	IIIe-2	44	5	63	-----	--
LnD2	Larkin silt loam, 20 to 45 percent slopes, eroded	25	IVe-2	49	5	63	-----	--
Lt	Latah silt loam	25	IIIw-2	48	--	--	Bottomland	58
MaC	Marble loamy sand, 0 to 30 percent slopes	26	VIIs-1	52	17	66	-----	--
MbC	Marble loamy coarse sand, 0 to 30 percent slopes	27	VIs-1	52	14	65	-----	--
McB	Marble sandy loam, 0 to 8 percent slopes	27	IVe-5	50	15	66	-----	--
Md	Mondovi silt loam	27	IIe-5	43	--	--	Bottomland	58
MmC	Moscow silt loam, 0 to 30 percent slopes	28	IVe-4	50	2	62	-----	--

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland group Number	Woodland group Page	Range site Name	Range site Page
MmD	Moscow silt loam, 30 to 55 percent slopes---	27	VIe-2	52	2	62	-----	--
MoC	Moscow silt loam, shallow, 0 to 20 percent slopes----------------------------------	28	VIe-2	52	6	63	-----	--
MoD	Moscow silt loam, shallow, 30 to 55 percent slopes----------------------------------	28	VIe-2	52	6	63	-----	--
MsC	Moscow very rocky complex, 0 to 30 percent slopes----------------------------------	28	*VIIs-2	52	*	--	-----	--
MsE	Moscow very rocky complex, 30 to 70 percent slopes----------------------------------	28	*VIIs-2	52	*	--	-----	--
NaA	Naff silt loam, 0 to 5 percent slopes-------	28	IIe-3	42	--	--	-----	--
NaA2	Naff silt loam, 0 to 5 percent slopes, eroded----------------------------------	29	IIe-3	42	--	--	-----	--
NaC	Naff silt loam, 5 to 30 percent slopes------	28	IIIe-2	44	--	--	-----	--
NaC2	Naff silt loam, 5 to 30 percent slopes, eroded----------------------------------	29	IIIe-2	44	--	--	-----	--
NaC3	Naff silt loam, 0 to 30 percent slopes, severely eroded--------------------------	29	IVe-3	49	--	--	-----	--
NaD2	Naff silt loam, 30 to 45 percent slopes, eroded----------------------------------	29	IVe-2	49	--	--	-----	--
NcA	Narcisse silt loam, 0 to 5 percent slopes---	29	IIIw-1	48	18	67	-----	--
NpA	Nez Perce silt loam, 0 to 5 percent slopes--	29	IIw-2	44	--	--	-----	--
NpB	Nez Perce silt loam, 5 to 20 percent slopes----------------------------------	30	IIIe-3	45	--	--	-----	--
NpB3	Nez Perce silt loam, 5 to 20 percent slopes, severely eroded------------------	30	IVe-3	49	--	--	-----	--
PaB	Palouse silt loam, moderately shallow, 0 to 20 percent slopes---------------------	30	IIIe-4	46	--	--	Shallow	59
PaC	Palouse silt loam, moderately shallow, 20 to 30 percent slopes------------------------	30	IIIe-4	46	--	--	Shallow	59
PbC2	Palouse silt loam, 5 to 30 percent slopes, eroded----------------------------------	30	IIIe-2	44	--	--	-----	--
PcC	Palouse very rocky complex, 0 to 30 percent slopes----------------------------------	30	*VIs-2	52	--	--	*	--
PcE	Palouse very rocky complex, 30 to 70 percent slopes---------------------------	30	*VIIs-2	52	--	--	*	--
PeA	Peone silt loam, 0 to 5 percent slopes------	31	IVw-1	51	--	--	Wet Meadow	59
PoA	Peone silt loam, drained, 0 to 5 percent slopes----------------------------------	31	IIIw-1	48	--	--	-----	--
PsA	Phoebe sandy loam, 0 to 5 percent slopes----	31	IIe-4	42	--	--	Loamy	59
PsB	Phoebe sandy loam, 5 to 20 percent slopes---	31	IIIe-5	46	--	--	Loamy	59
RdA	Reardan silt loam, 0 to 5 percent slopes----	32	IIe-1	41	--	--	Loamy	59
RdB	Reardan silt loam, 5 to 20 percent slopes---	31	IIIe-1	44	--	--	Loamy	59
RdB2	Reardan silt loam, 5 to 20 percent slopes, eroded----------------------------------	32	IIIe-1	44	--	--	-----	--
RdC2	Reardan silt loam, 20 to 30 percent slopes, eroded----------------------------------	32	IIIe-1	44	--	--	-----	--
Rh	Riverwash----------------------------------	32	VIIIw-1	52	--	--	-----	--
Ro	Rock outcrop-------------------------------	32	VIIIs-1	52	--	--	-----	--
SaB	Schumacher silt loam, 0 to 20 percent slopes----------------------------------	32	IIIe-2	44	--	--	Loamy	59
SaB2	Schumacher silt loam, 0 to 20 percent slopes, eroded--------------------------	33	IIIe-2	44	--	--	-----	--
SaC	Schumacher silt loam, 20 to 30 percent slopes----------------------------------	32	IIIe-2	44	--	--	Loamy	59
SaC2	Schumacher silt loam, 20 to 30 percent slopes, eroded--------------------------	33	IIIe-2	44	--	--	-----	--
SaD	Schumacher silt loam, 30 to 55 percent slopes----------------------------------	33	VIe-1	52	--	--	North Exposure	59
ScC	Schumacher gravelly silt loam, 5 to 30 percent slopes--------------------------	33	IVe-4	50	--	--	Loamy	59

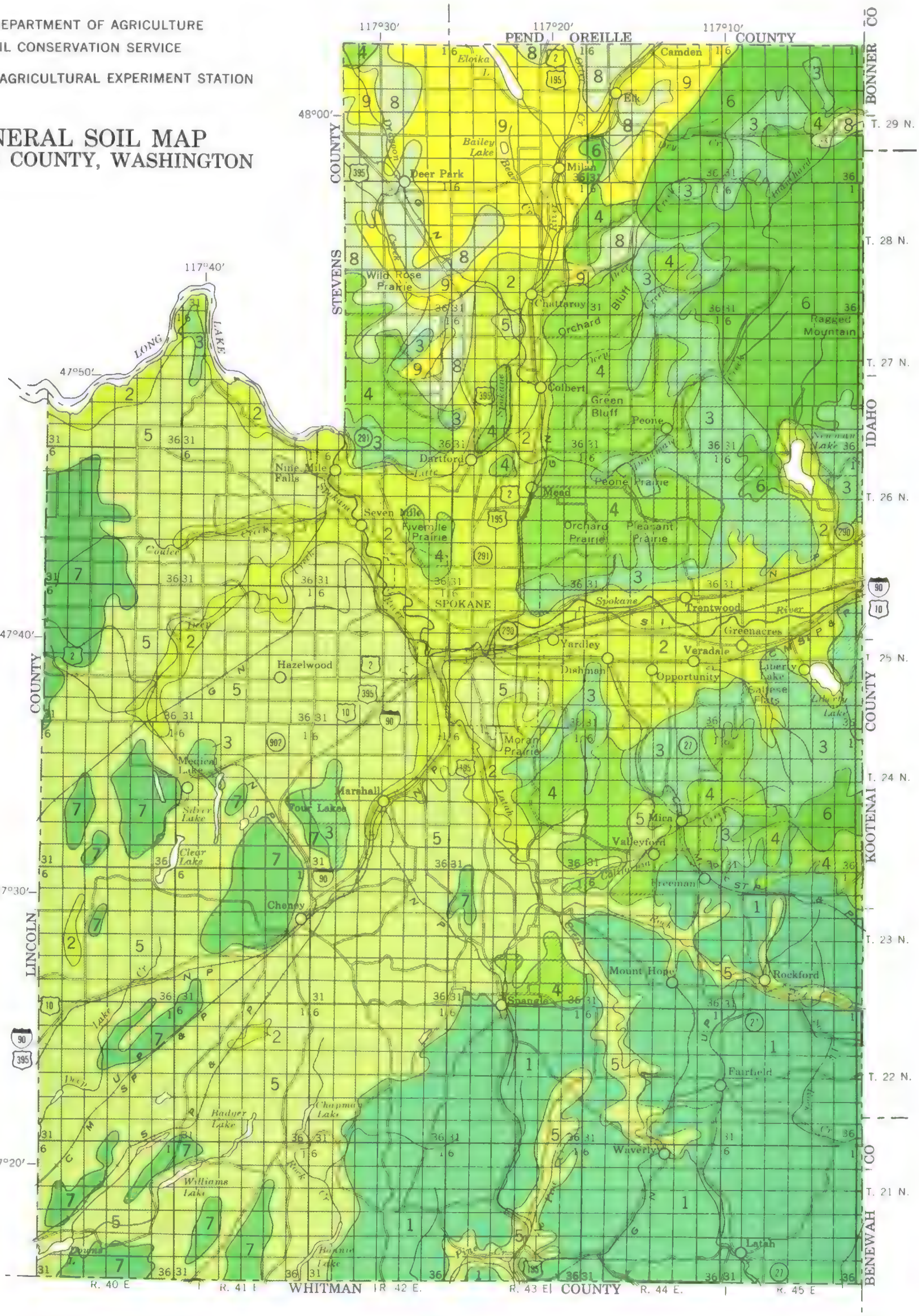
GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland group Number	Woodland group Page	Range site Name	Range site Page
ScC2	Schumacher gravelly silt loam, 5 to 30 percent slopes, eroded	33	IVe-4	50	--	--	-----	--
ScD	Schumacher gravelly silt loam, 30 to 55 percent slopes	33	VIe-1	52	--	--	North Exposure	59
ScD2	Schumacher gravelly silt loam, 30 to 55 percent slopes, eroded	34	VIe-1	52	--	--	-----	--
Se	Semiahmoo muck	34	Vw-1	52	--	--	Wet Meadow	59
Sk	Semiahmoo muck, drained	34	IIIw-5	49	--	--	-----	--
Sm	Semiahmoo muck, moderately shallow, drained	34	IIIw-5	49	--	--	-----	--
SnA	Snow silt loam, 0 to 5 percent slopes	34	IIe-5	43	--	--	-----	--
SnC	Snow silt loam, 5 to 30 percent slopes	34	IIIe-2	44	--	--	-----	--
SoE	Speigle very stony silt loam, 30 to 70 percent slopes	35	VIIs-1	52	8	64	-----	--
SpC	Spokane loam, 0 to 30 percent slopes	35	IVe-4	50	6	63	-----	--
SpD	Spokane loam, 30 to 55 percent slopes	35	VIe-2	52	6	63	-----	--
SrC	Spokane stony loam, 0 to 30 percent slopes	35	VIs-1	52	7	64	-----	--
SrE	Spokane stony loam, 30 to 70 percent slopes	35	VIIs-1	52	7	64	-----	--
SsC	Spokane complex, 0 to 30 percent slopes	35	*VIe-2	52	*	--	-----	--
SsE	Spokane complex, 30 to 70 percent slopes	36	*VIIe-1	52	*	--	-----	--
StC	Spokane very rocky complex, 0 to 30 percent slopes	36	*VIIs-2	52	*	--	-----	--
StE	Spokane very rocky complex, 30 to 70 percent slopes	36	*VIIs-2	52	*	--	-----	--
SuE	Spokane extremely rocky complex, 20 to 70 percent slopes	36	*VIIs-2	52	*	--	-----	--
SwB	Springdale gravelly sandy loam, 0 to 20 percent slopes	36	VIe-2	52	17	66	-----	--
SxB	Springdale gravelly sandy loam, deep, 0 to 20 percent slopes	36	IVe-5	50	15	66	-----	--
SyB	Springdale cobbly sandy loam, 0 to 20 percent slopes	37	VIIs-1	52	17	66	-----	--
SzE	Springdale gravelly loamy sand, 30 to 70 percent slopes	36	VIIs-1	52	19	67	-----	--
TeB	Tekoa gravelly silt loam, 5 to 20 percent slopes	37	IVe-4	50	7	64	-----	--
TeC	Tekoa gravelly silt loam, 20 to 30 percent slopes	37	VIe-2	52	7	64	-----	--
TeD	Tekoa gravelly silt loam, 30 to 55 percent slopes	37	VIe-2	52	7	64	-----	--
TkD	Tekoa very rocky complex, 25 to 55 percent slopes	37	*VIIs-2	52	*	--	-----	--
UhA	Uhlig silt loam, 0 to 5 percent slopes	38	------	--	--	--	-----	--
	15 to 18 inches precipitation	--	IIe-1	41	--	--	Loamy	59
	18 to 21 inches precipitation	--	IIe-2	42	--	--	Loamy	59
UhB	Uhlig silt loam, 5 to 20 percent slopes	37	------	--	--	--	-----	--
	15 to 18 inches precipitation	--	IIIe-2	44	--	--	Loamy	59
	18 to 21 inches precipitation	--	IIIe-1	44	--	--	Loamy	59
UmC	Uhlig silt loam, moderately shallow, 5 to 30 percent slopes	38	IIIe-4	46	--	--	Shallow	59
VaC	Vassar silt loam, 0 to 30 percent slopes	38	VIe-2	52	1	62	-----	--
VaD	Vassar silt loam, 30 to 55 percent slopes	38	VIe-2	52	1	62	-----	--
VsD	Vassar very rocky silt loam, 20 to 55 percent slopes	38	*VIIs-2	52	*	--	-----	--
We	Wethey loamy sand	38	Vw-1	52	--	--	Wet Meadow	59
Wh	Wethey loamy sand, drained	38	IIIw-4	48	--	--	-----	--
Wo	Wolfeson very fine sandy loam	39	IIIw-3	48	18	67	-----	--

Accessibility Statement

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
SPOKANE COUNTY, WASHINGTON



SOIL ASSOCIATIONS

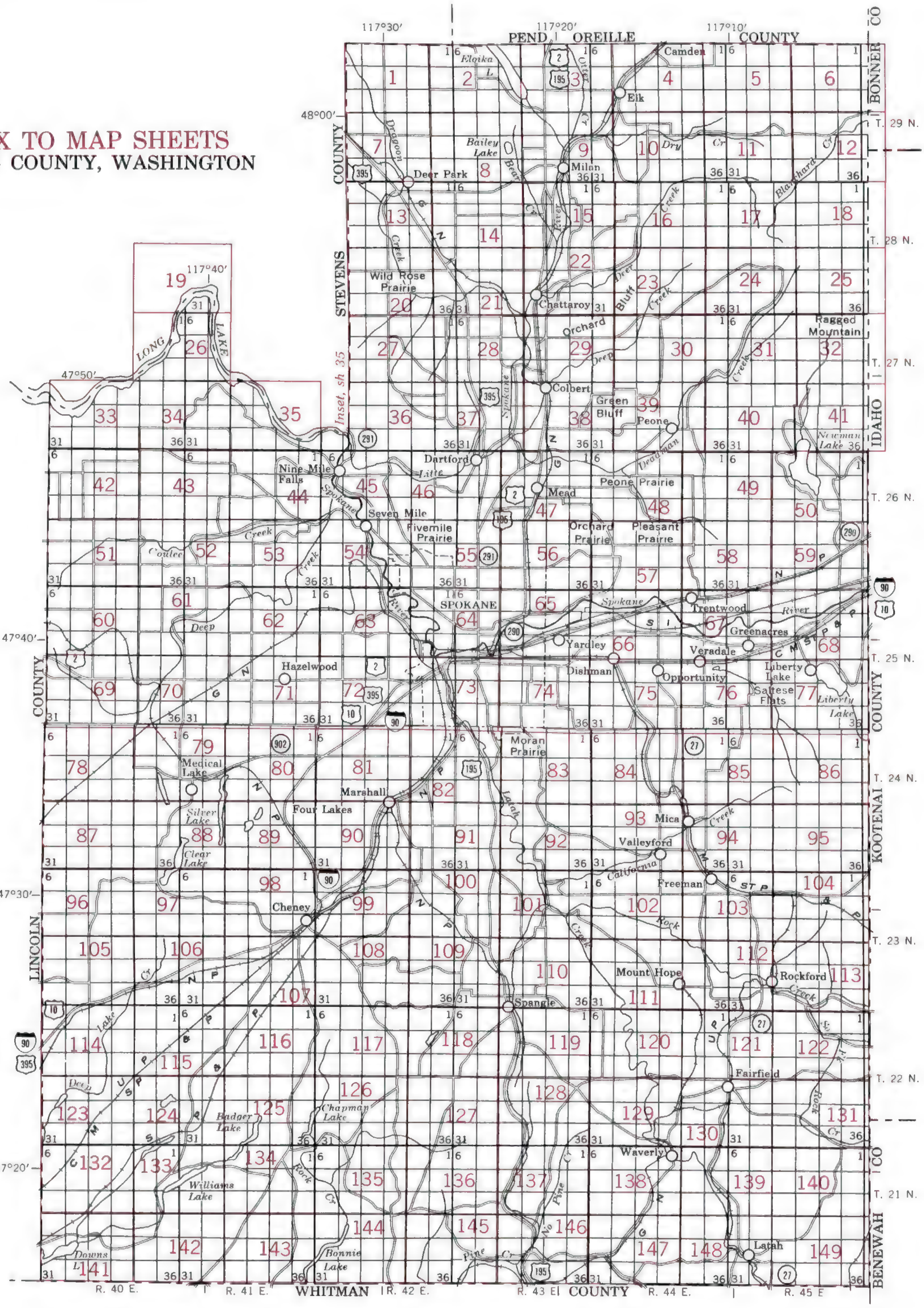
- 1 — Naff-Larkin-Freeman association: Medium-textured to fine-textured soils on rolling loessal uplands, glacial till plains, and mountain foot slopes
- 2 — Garrison-Marble-Springdale association: Somewhat excessively drained and excessively drained sandy and gravelly soils formed in glacial outwash
- 3 — Spokane-Dragoon association: Shallow to deep, medium-textured soils that formed in material weathered from acid igneous rock on mountain foot slopes
- 4 — Bernhill association: Deep, well drained and moderately well drained soils that formed chiefly in glacial lake sediments and glacial till on uplands
- 5 — Hesseltine-Cheney-Uhlig association: Dominantly moderately deep to shallow, gravelly or rocky soils of the channeled scablands
- 6 — Moscow-Vassar association: Moderately deep and deep, medium-textured soils of the hilly and mountainous areas
- 7 — Athena-Reardan association: Medium-textured and moderately fine textured soils formed chiefly in loess
- 8 — Clayton-Laketon association: Very deep, medium-textured and moderately coarse textured soils on terraces
- 9 — Bonner-Eloika-Hagen association: Gravelly and sandy soils that formed in glacial materials

June 1966

Scale 1:316,800

1 0 1 2 3 4 5 Miles

INDEX TO MAP SHEETS
SPOKANE COUNTY, WASHINGTON



Scale 1:316,800

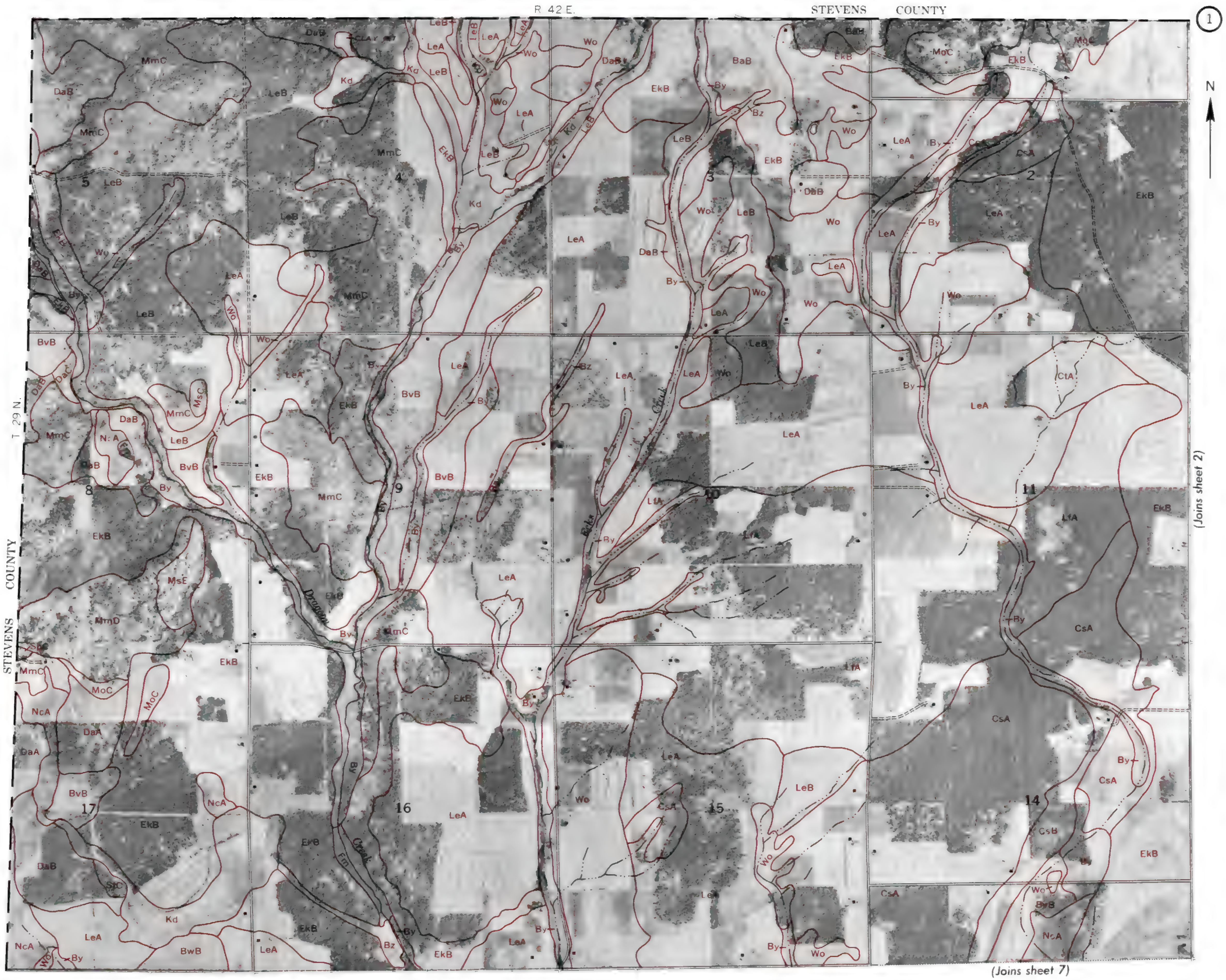
1 0 1 2 3 4 5 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Some symbols without a slope letter are those of nearly level or gently sloping soils or land types, but some are for soils or land types that have considerable range in slope. A final number, 2 or 3, in a symbol means that a soil is eroded or severely eroded.

SYMBOL	NAME
AaA	Athena silt loam, 0 to 5 percent slopes
AaC	Athena silt loam, 5 to 30 percent slopes
AaD	Athena silt loam, 30 to 55 percent slopes
AaE	Athena silt loam, 55 to 70 percent slopes
AlC	Athena–Lance silt loams, 0 to 30 percent slopes
AlD	Athena–Lance silt loams, 30 to 55 percent slopes
BaB	Bernhill silt loam, 0 to 20 percent slopes
BaC	Bernhill silt loam, 20 to 30 percent slopes
BaD	Bernhill silt loam, 30 to 55 percent slopes
BbB	Bernhill silt loam, moderately shallow, 0 to 20 percent slopes
BbD	Bernhill silt loam, moderately shallow, 30 to 55 percent slopes
BeB	Bernhill gravelly silt loam, 0 to 20 percent slopes
BfB	Bernhill very stony silt loam, 0 to 20 percent slopes
BfD	Bernhill very stony silt loam, 20 to 55 percent slopes
BhD	Bernhill soils, 20 to 55 percent slopes
BkC	Bernhill very rocky complex, 0 to 30 percent slopes
BkD	Bernhill very rocky complex, 30 to 55 percent slopes
BoB	Bong coarse sandy loam, 0 to 8 percent slopes
BpB	Bong and Phoebe fine sandy loams, 0 to 8 percent slopes
BrB	Bong and Phoebe coarse sandy loams, 0 to 20 percent slopes
BrC	Bong and Phoebe coarse sandy loams, 20 to 30 percent slopes
BsB	Bong and Phoebe loamy sands, 0 to 20 percent slopes
BtB	Bonner silt loam, 0 to 8 percent slopes
BuB	Bonner gravelly silt loam, 0 to 20 percent slopes
BvB	Bonner loam, 0 to 20 percent slopes
BwB	Bonner fine sandy loam, 0 to 20 percent slopes
BxD	Brickel stony loam, 20 to 55 percent slopes
By	Bridgeson silt loam
Bz	Bridgeson silt loam, drained
Ca	Caldwell silt loam
CeA	Cedonia silt loam, 0 to 5 percent slopes
CeB	Cedonia silt loam, 5 to 20 percent slopes
CeC3	Cedonia silt loam, 20 to 30 percent slopes, severely eroded
CgB	Cheney gravelly silt loam, 0 to 8 percent slopes
ChB	Cheney stony silt loam, 0 to 20 percent slopes
CkC	Cheney very rocky complex, 0 to 30 percent slopes
CmC	Cheney extremely rocky complex, 0 to 30 percent slopes
CnB	Cheney and Uhlig silt loams, 0 to 8 percent slopes
CoB	Cheney–Uhlig complex, 0 to 8 percent slopes
CsA	Clayton fine sandy loam, 0 to 5 percent slopes
CsB	Clayton fine sandy loam, 5 to 20 percent slopes
CtA	Clayton loam, 0 to 5 percent slopes
CtB	Clayton loam, 5 to 20 percent slopes
CuB	Clayton sandy loam, 0 to 8 percent slopes
Cw	Cocolalla silty clay loam
Cy	Cocolalla silty clay loam, drained
DaA	Dearyton silt loam, 0 to 5 percent slopes
DaB	Dearyton silt loam, 5 to 20 percent slopes
DaC	Dearyton silt loam, 20 to 40 percent slopes
DeB	Dearyton silt loam, thin solum variant, 0 to 20 percent slopes
DrC	Dragoon silt loam, 0 to 30 percent slopes
DsC	Dragoon stony silt loam, 0 to 30 percent slopes
DsD	Dragoon stony silt loam, 30 to 55 percent slopes
DvD	Dragoon very rocky complex, 20 to 55 percent slopes
EkB	Eloika silt loam, 0 to 20 percent slopes
EsC	Eloika very stony silt loam, 0 to 30 percent slopes
EsD	Eloika very stony silt loam, 30 to 55 percent slopes
Em	Emdent silt loam
FaB	Freeman silt loam, 5 to 20 percent slopes
FaB3	Freeman silt loam, 5 to 20 percent slopes, severely eroded
FaC3	Freeman silt loam, 20 to 30 percent slopes, severely eroded
Fm	Fresh water marsh
GaC3	Garfield silty clay loam, 0 to 30 percent slopes, severely eroded
GgA	Garrison gravelly loam, 0 to 5 percent slopes
GgB	Garrison gravelly loam, 5 to 20 percent slopes
GmB	Garrison very gravelly loam, 0 to 8 percent slopes
GnB	Garrison very stony loam, 0 to 20 percent slopes
GpA	Glenrose silt loam, 0 to 5 percent slopes
GpB	Glenrose silt loam, 5 to 20 percent slopes
GpC	Glenrose silt loam, 20 to 30 percent slopes
GpD	Glenrose silt loam, 30 to 55 percent slopes
GrB	Glenrose gravelly silt loam, 5 to 20 percent slopes
GrD	Glenrose gravelly silt loam, 20 to 55 percent slopes
GsD	Glenrose stony silt loam, 20 to 55 percent slopes
GtA	Green Bluff silt loam, 0 to 5 percent slopes
GtB	Green Bluff silt loam, 5 to 20 percent slopes
HfC	Hagen loamy fine sand, 0 to 30 percent slopes
HgB	Hagen sandy loam, 0 to 20 percent slopes
HhA	Hardesty silt loam, 0 to 5 percent slopes
HmA	Hardesty silt loam, moderately shallow, 0 to 5 percent slopes
HnB	Hesseltine silt loam, 0 to 10 percent slopes
HoB	Hesseltine silt loam, moderately deep, 0 to 8 percent slopes
HrB	Hesseltine gravelly silt loam, 0 to 10 percent slopes
HsB	Hesseltine stony silt loam, 0 to 20 percent slopes
HtB	Hesseltine stony silt loam, mounded, 0 to 8 percent slopes
HvC	Hesseltine very rocky complex, 0 to 30 percent slopes
HvD	Hesseltine very rocky complex, 30 to 55 percent slopes
HxC	Hesseltine extremely rocky complex, 0 to 30 percent slopes
Kc	Konner silty clay loam
Kd	Konner silty clay loam, drained
LaB	Lakesol silt loam, 0 to 20 percent slopes
LaD	Lakesol silt loam, 20 to 55 percent slopes
LeA	Laketon silt loam, 0 to 5 percent slopes
LeB	Laketon silt loam, 5 to 20 percent slopes
LfA	Laketon fine sandy loam, 0 to 5 percent slopes
LmC	Lance silt loam, 0 to 30 percent slopes
LmC3	Lance silt loam, 0 to 30 percent slopes, severely eroded
LnA2	Larkin silt loam, 0 to 5 percent slopes, eroded
LnB2	Larkin silt loam, 5 to 20 percent slopes, eroded
LnD2	Larkin silt loam, 20 to 45 percent slopes, eroded
Lt	Latah silt loam
MaC	Marble loamy sand, 0 to 30 percent slopes
MbC	Marble loamy coarse sand, 0 to 30 percent slopes
McB	Marble sandy loam, 0 to 8 percent slopes
Md	Mondovi silt loam
MmC	Moscow silt loam, 0 to 30 percent slopes
MmD	Moscow silt loam, 30 to 55 percent slopes
MoC	Moscow silt loam, shallow, 0 to 30 percent slopes
MoD	Moscow silt loam, shallow, 30 to 55 percent slopes
MsC	Moscow very rocky complex, 0 to 30 percent slopes
MsE	Moscow very rocky complex, 30 to 70 percent slopes
NaA	Naff silt loam, 0 to 5 percent slopes
NaA2	Naff silt loam, 0 to 5 percent slopes, eroded
NaC	Naff silt loam, 5 to 30 percent slopes
NaC2	Naff silt loam, 5 to 30 percent slopes, eroded
NaC3	Naff silt loam, 0 to 30 percent slopes, severely eroded
NaD2	Naff silt loam, 30 to 45 percent slopes, eroded
NcA	Narcisse silt loam, 0 to 5 percent slopes
NpA	Nez Perce silt loam, 0 to 5 percent slopes
NpB	Nez Perce silt loam, 5 to 20 percent slopes
NpB3	Nez Perce silt loam, 5 to 20 percent slopes, severely eroded
PaB	Palouse silt loam, moderately shallow, 0 to 20 percent slopes
PaC	Palouse silt loam, moderately shallow, 20 to 30 percent slopes
PbC2	Palouse silt loam, 5 to 30 percent slopes, eroded
PcC	Palouse very rocky complex, 0 to 30 percent slopes
PcE	Palouse very rocky complex, 30 to 70 percent slopes
PeA	Peone silt loam, 0 to 5 percent slopes
PoA	Peone silt loam, drained, 0 to 5 percent slopes
PsA	Phoebe sandy loam, 0 to 5 percent slopes
PsB	Phoebe sandy loam, 5 to 20 percent slopes
RdA	Reardan silt loam, 0 to 5 percent slopes
RdB	Reardan silt loam, 5 to 20 percent slopes
RdB2	Reardan silt loam, 5 to 20 percent slopes, eroded
RdC2	Reardan silt loam, 20 to 30 percent slopes, eroded
Rh	Riverwash
Ro	Rock outcrop
SaB	Schumacher silt loam, 0 to 20 percent slopes
SaB2	Schumacher silt loam, 0 to 20 percent slopes, eroded
SaC	Schumacher silt loam, 20 to 30 percent slopes
SaC2	Schumacher silt loam, 20 to 30 percent slopes, eroded
SaD	Schumacher silt loam, 30 to 55 percent slopes
ScC	Schumacher gravelly silt loam, 5 to 30 percent slopes
ScC2	Schumacher gravelly silt loam, 5 to 30 percent slopes, eroded
ScD	Schumacher gravelly silt loam, 30 to 55 percent slopes
ScD2	Schumacher gravelly silt loam, 30 to 55 percent slopes, eroded
Se	Semiahmoo muck
Sk	Semiahmoo muck, drained
Sm	Semiahmoo muck, moderately shallow, drained
SnA	Snow silt loam, 0 to 5 percent slopes
SnC	Snow silt loam, 5 to 30 percent slopes
SoE	Speigle very stony silt loam, 30 to 70 percent slopes
SpC	Spokane loam, 0 to 30 percent slopes
SpD	Spokane loam, 30 to 55 percent slopes
SrC	Spokane stony loam, 0 to 30 percent slopes
SrE	Spokane stony loam, 30 to 70 percent slopes
SsC	Spokane complex, 0 to 30 percent slopes
SsE	Spokane complex, 30 to 70 percent slopes
StC	Spokane very rocky complex, 0 to 30 percent slopes
StE	Spokane very rocky complex, 30 to 70 percent slopes
SuE	Spokane extremely rocky complex, 20 to 70 percent slopes
SwB	Springdale gravelly sandy loam, 0 to 20 percent slopes
SxB	Springdale gravelly sandy loam, deep, 0 to 20 percent slopes
SyB	Springdale cobbly sandy loam, 0 to 20 percent slopes
SzE	Springdale gravelly loamy sand, 30 to 70 percent slopes
TeB	Tekoa gravelly silt loam, 5 to 20 percent slopes
TeC	Tekoa gravelly silt loam, 20 to 30 percent slopes
TeD	Tekoa gravelly silt loam, 30 to 55 percent slopes
TkD	Tekoa very rocky complex, 25 to 55 percent slopes
UhA	Uhlig silt loam, 0 to 5 percent slopes
UhB	Uhlig silt loam, 5 to 20 percent slopes
UmC	Uhlig silt loam, moderately shallow, 5 to 30 percent slopes
VaC	Vassar silt loam, 0 to 30 percent slopes
VaD	Vassar silt loam, 30 to 55 percent slopes
VsD	Vassar very rocky silt loam, 20 to 55 percent slopes
We	Wethey loamy sand
Wh	Wethey loamy sand, drained
Wo	Wolfeson very fine sandy loam

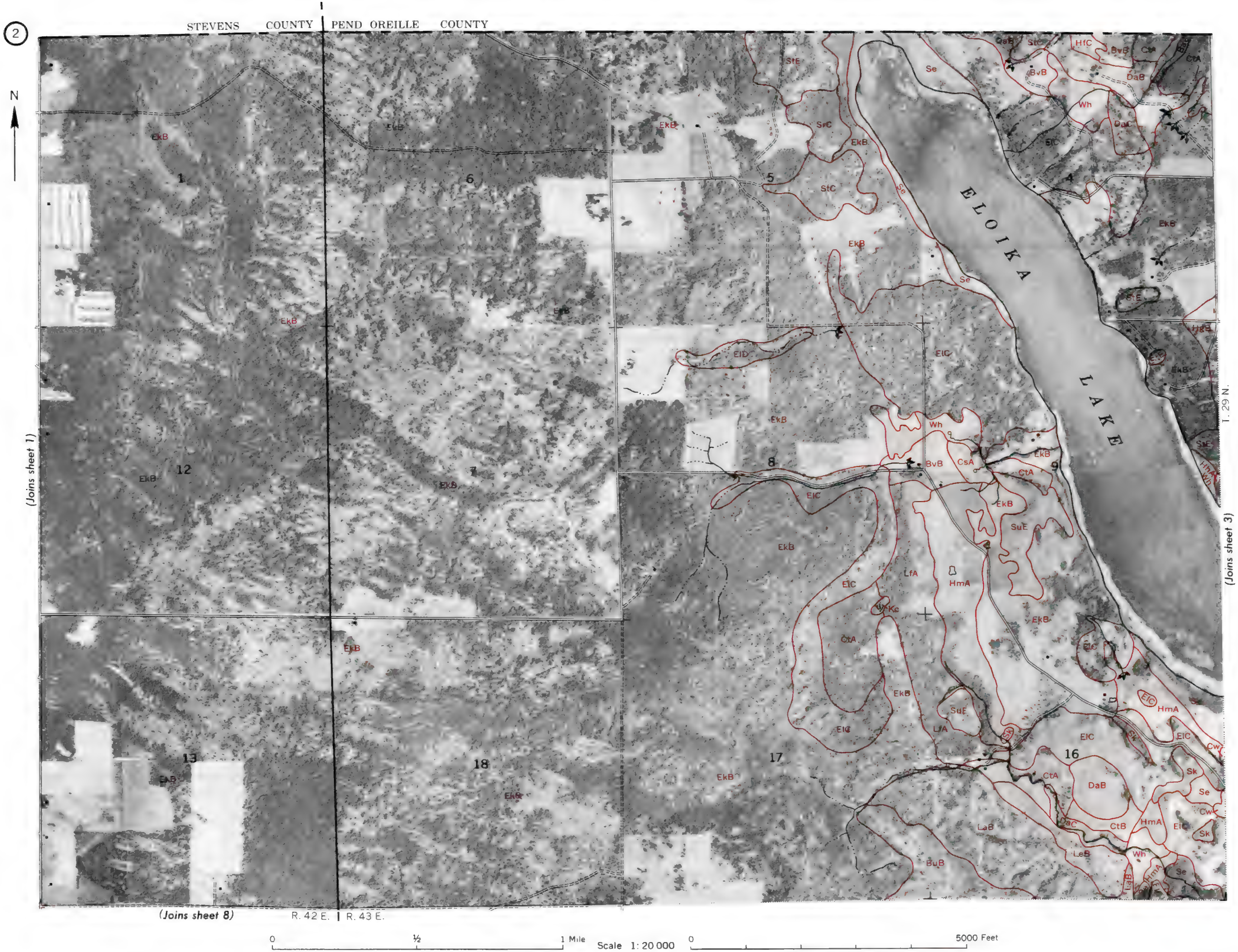
Soil map constructed 1965 by Cartographic Division, Soil Conservation Service, USDA, from 1950 aerial photographs. Controlled mosaic based on Washington plane coordinate system, north zone, Lambert conformal conic projection, 1927 North American datum.

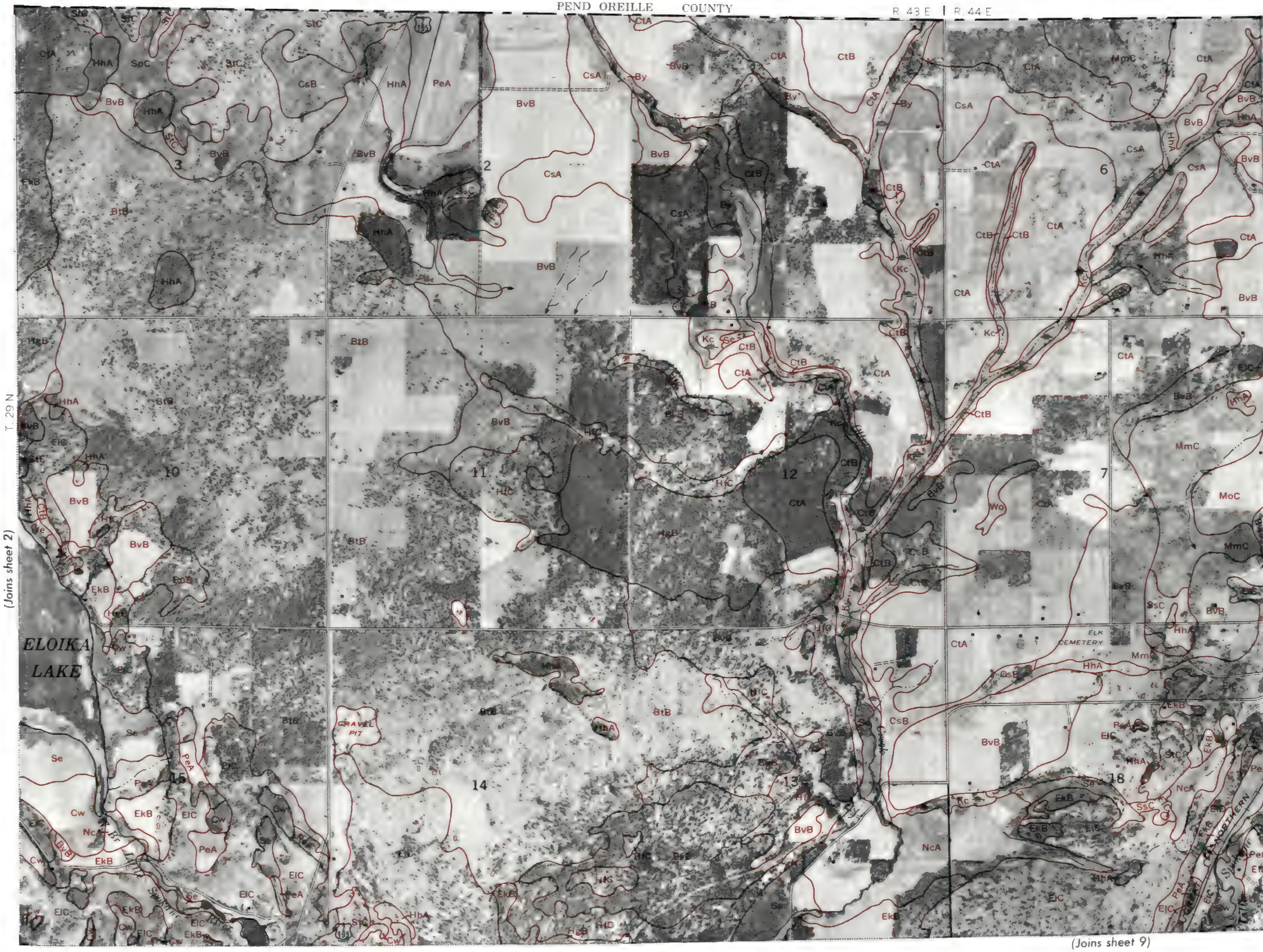


This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

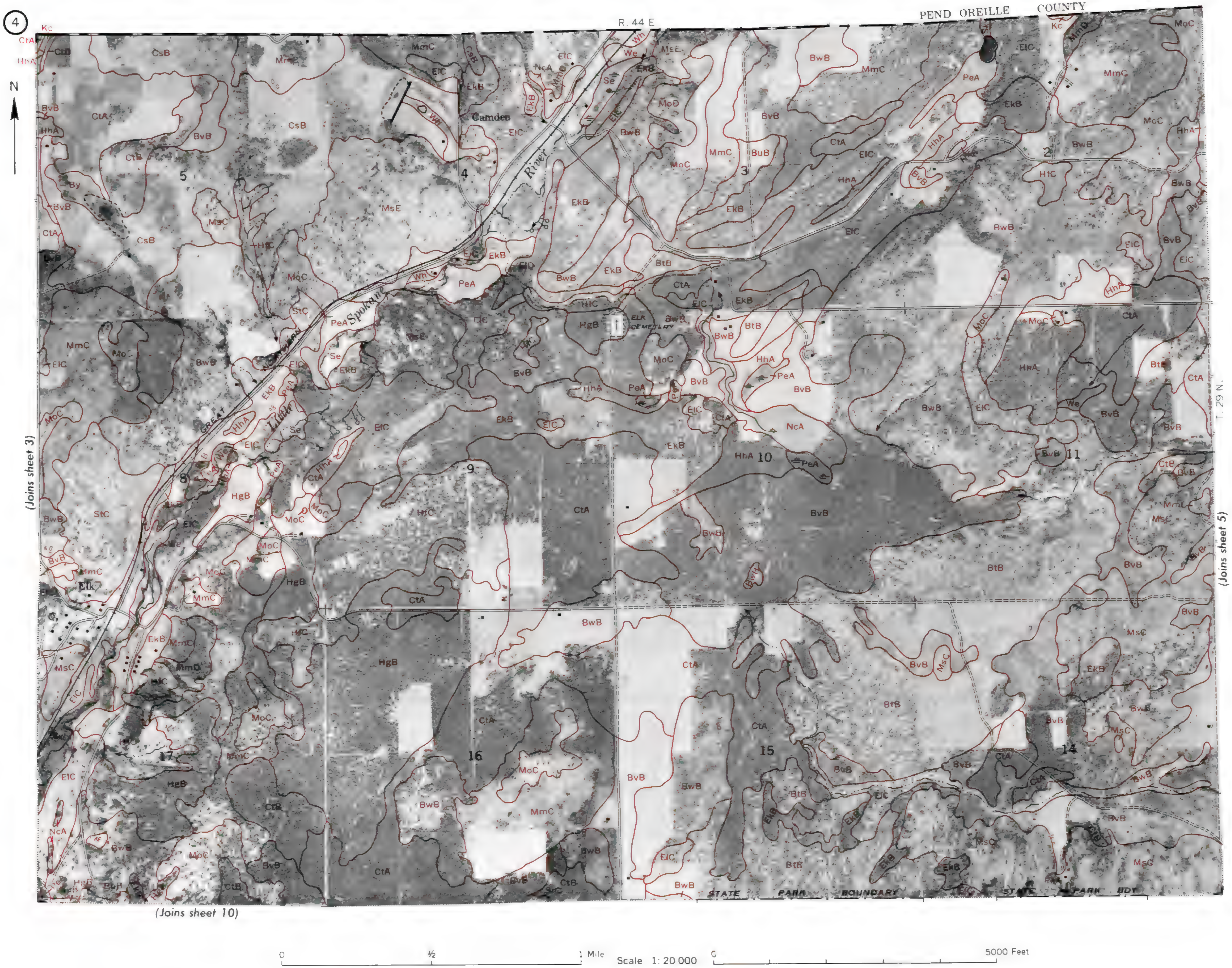

2
STEVENS COUNTY
PEND OREILLE COUNTY
N
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 8)
T. 29 N.
R. 42 E.
R. 43 E.
ELOIKA LAKE
1
4
5
6
7
8
9
12
13
16
17
18
EkB
StE
Se
StC
SrC
HfC
BvB
CtA
DaB
DaC
Wh
EIC
EID
CsA
SuE
LfA
HmA
Kc
LaB
LeB
BuB
CtB
Sk
Cw
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

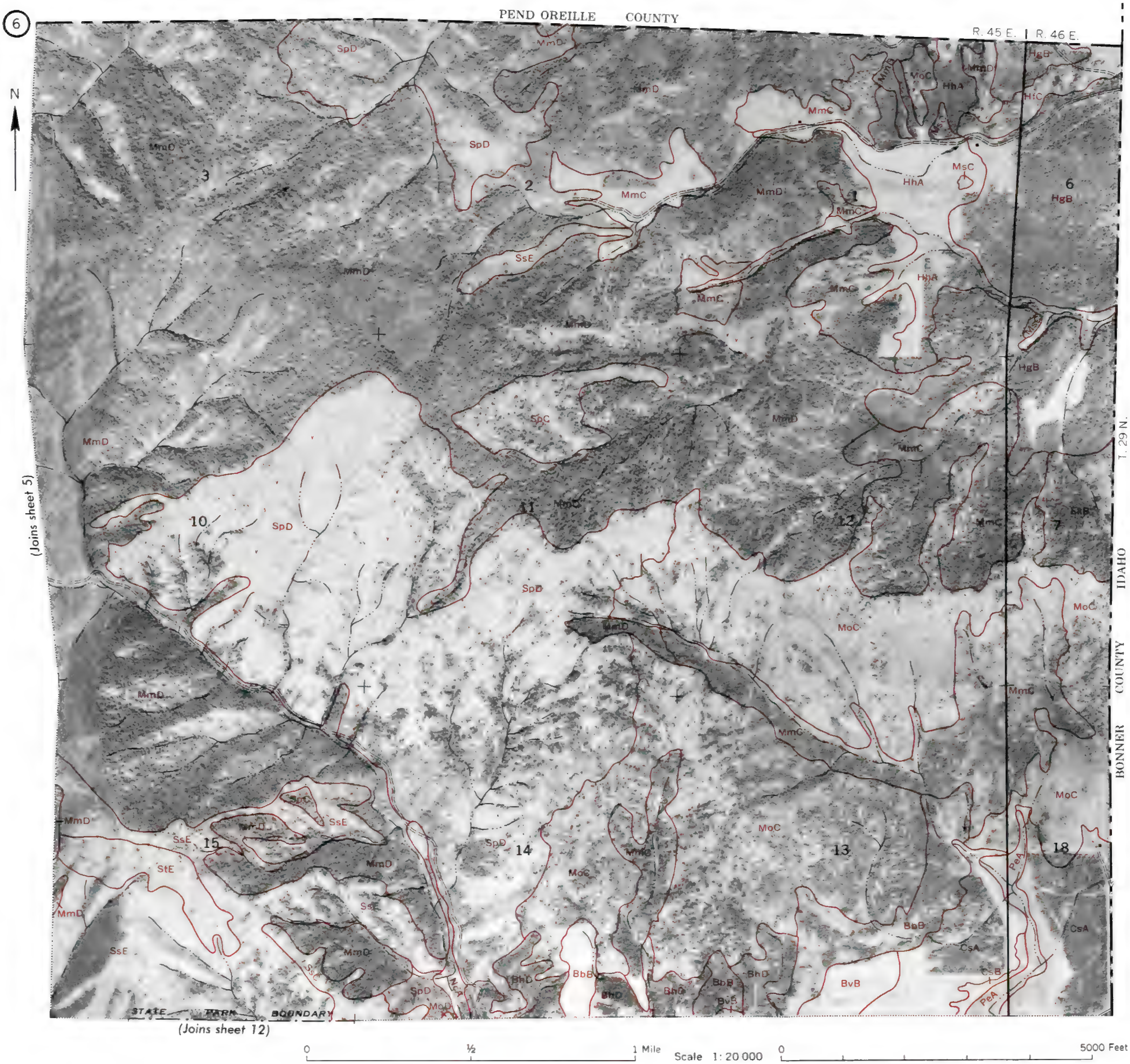
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

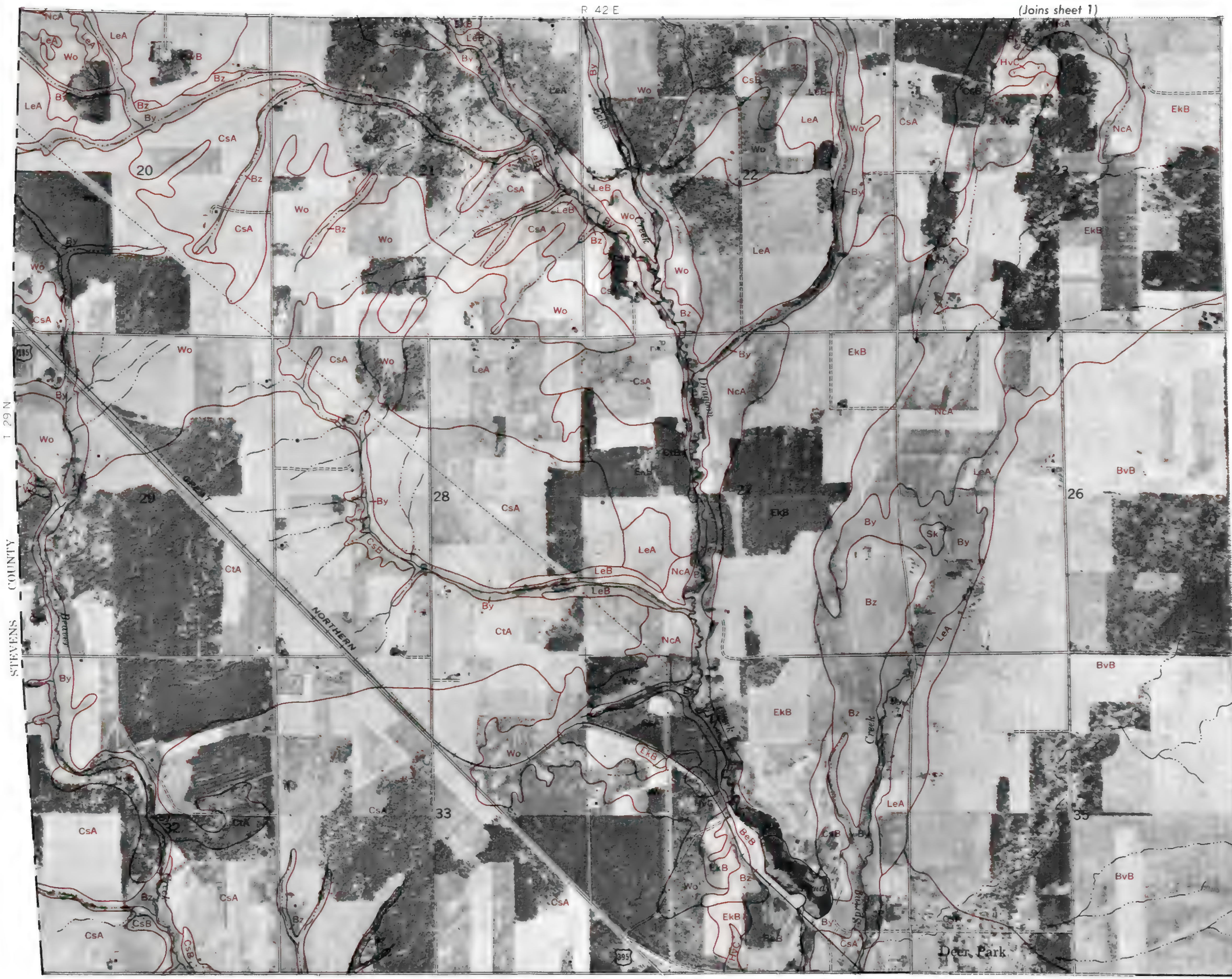

4
N
R. 44 E.
PEND OREILLE COUNTY
T. 29 N.
Camden
Spokane River
Little Spokane
GREAT NORTHERN
ELK CEMETERY
Elk
STATE PARK BOUNDARY
STATE PARK BDY
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 10)
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


6
PEND OREILLE COUNTY
R. 45 E.
R. 46 E.
N
T. 29 N.
IDAHO
BONNER COUNTY
(Joins sheet 5)
(Joins sheet 12)
STATE PARK BOUNDARY
SpD
MmD
MmC
MoC
HhA
HgB
HiC
MsC
SsE
SpC
StE
BbB
BhD
BvB
CsA
CsB
PeA
1
2
3
6
7
10
11
12
13
14
15
18
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

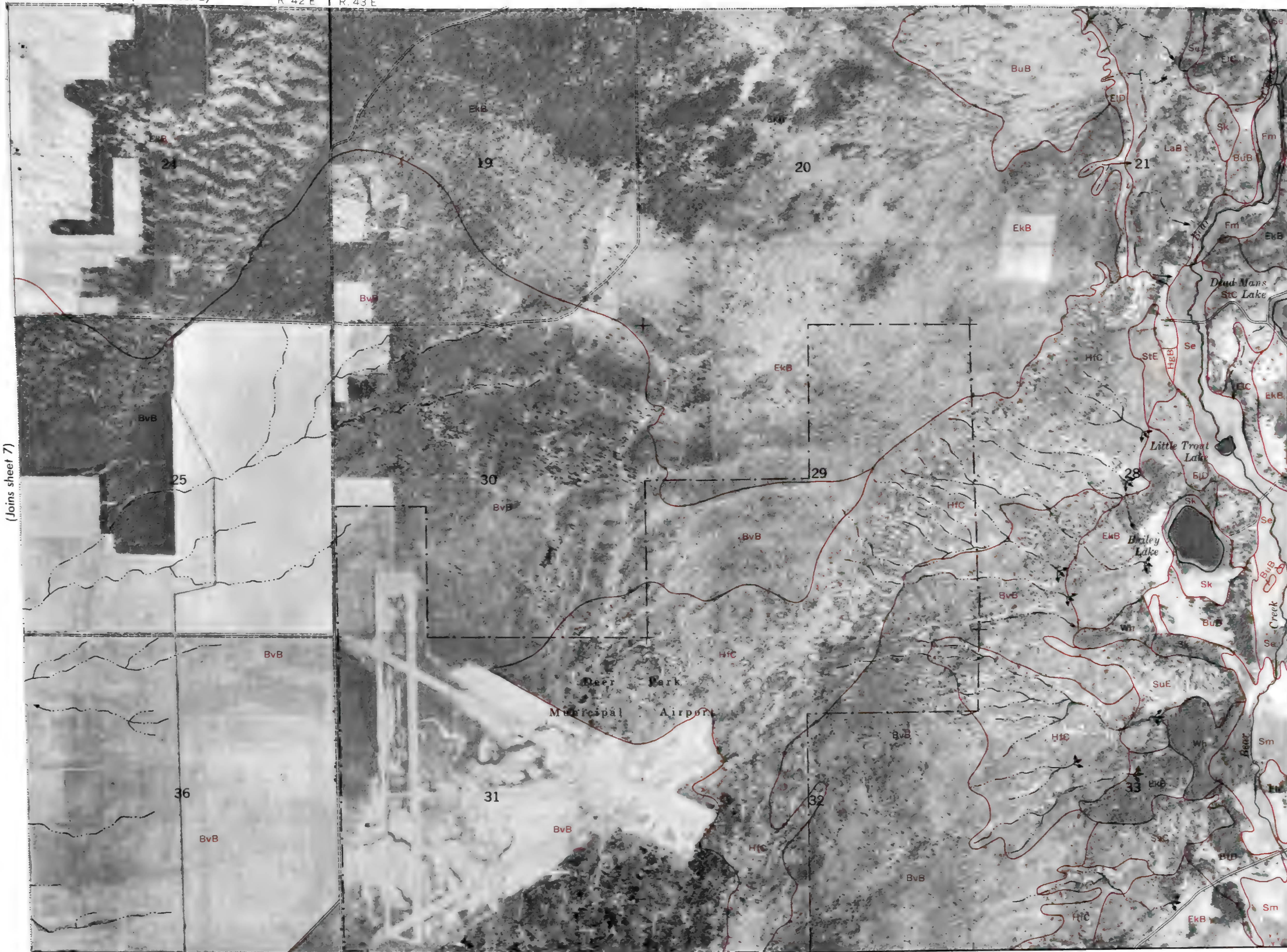
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite.

8

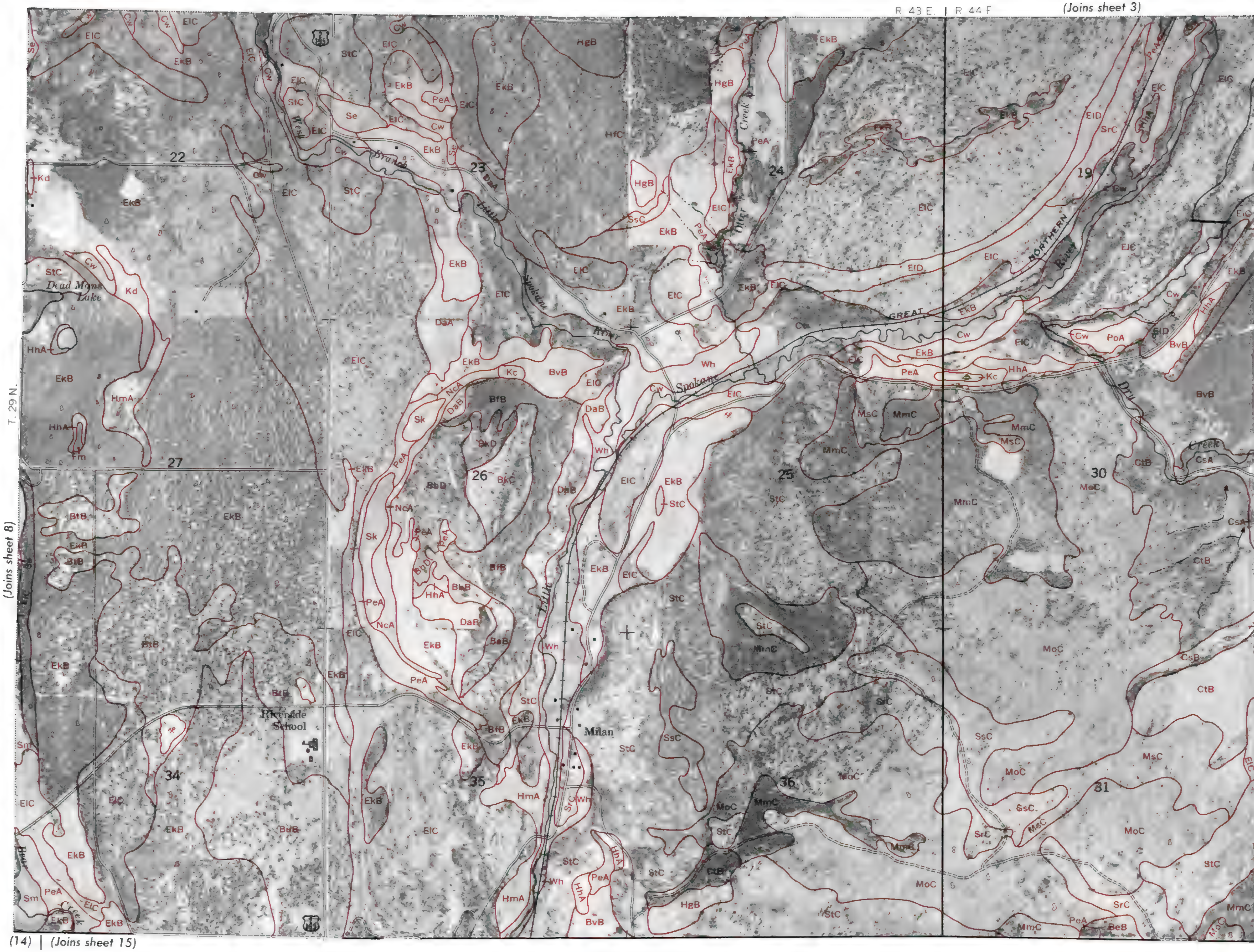
(Joins sheet 2)

R. 42 E | R. 43 E



(13) | (Joins sheet 14)

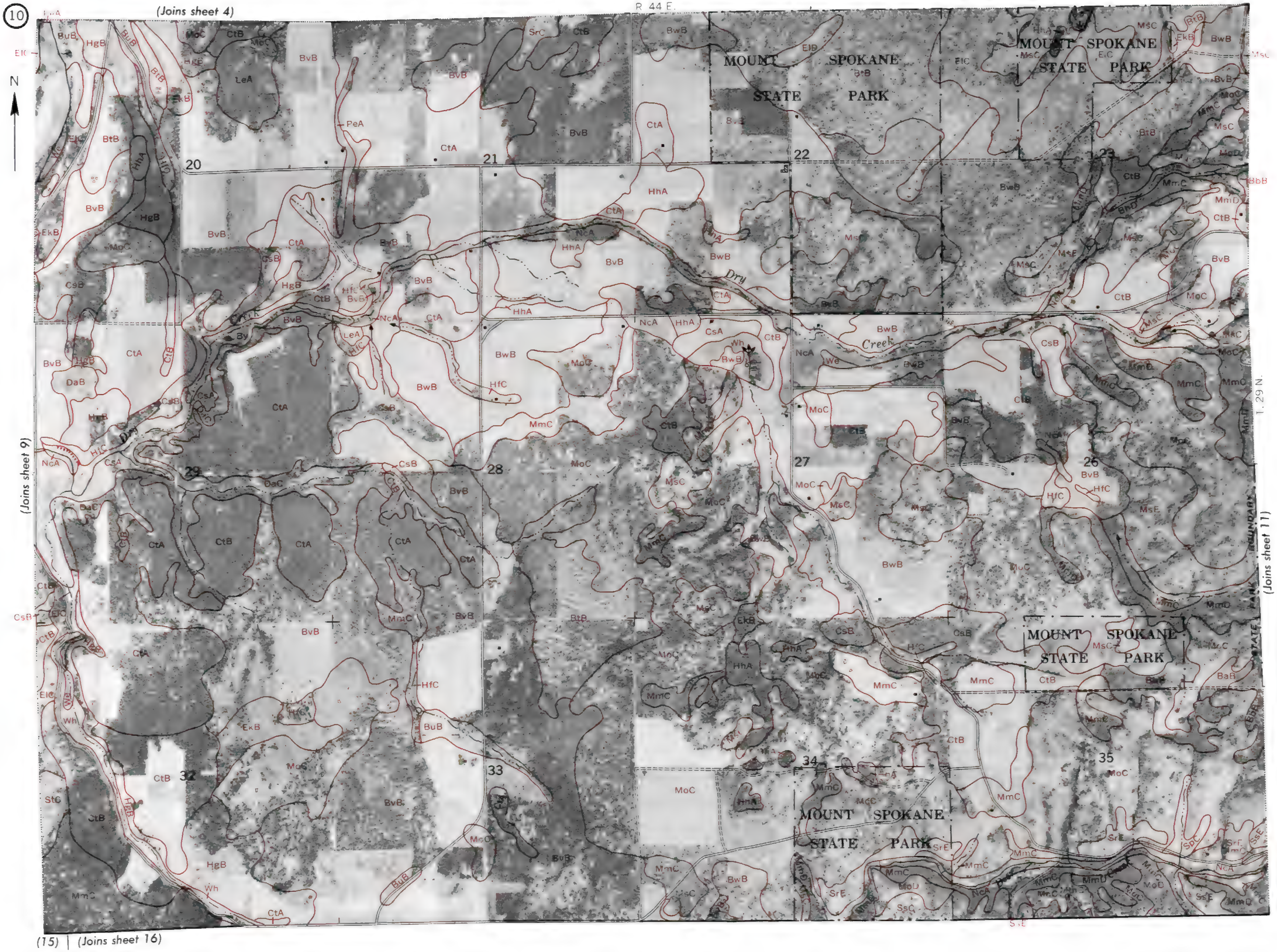
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite

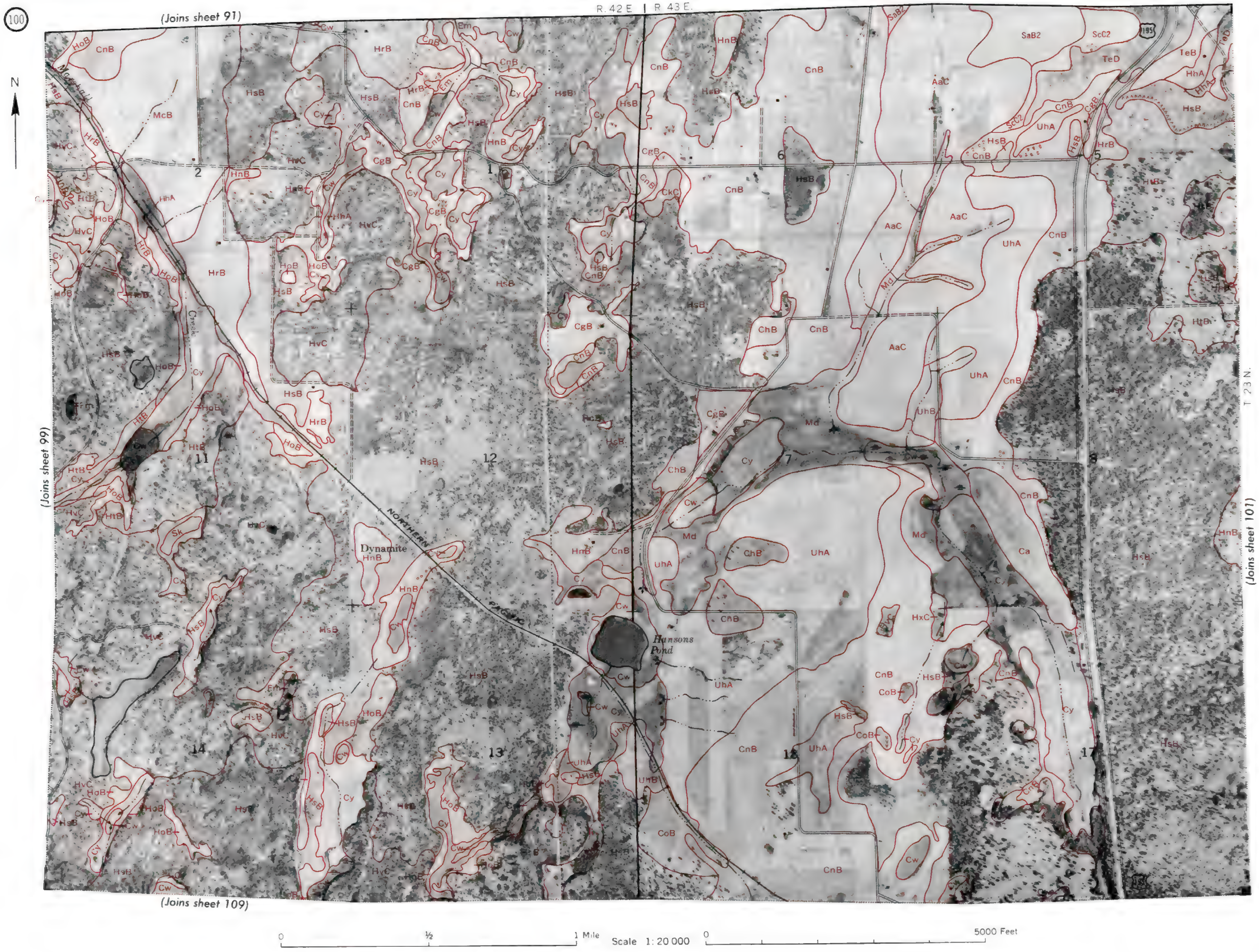


(15) | (Joins sheet 16)

Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet


100
(Joins sheet 91)
R. 42 E. | R. 43 E.
N
(Joins sheet 99)
(Joins sheet 101)
T. 23 N.
(Joins sheet 109)
NORTHERN PACIFIC
Dynamite
Hansons Pond
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

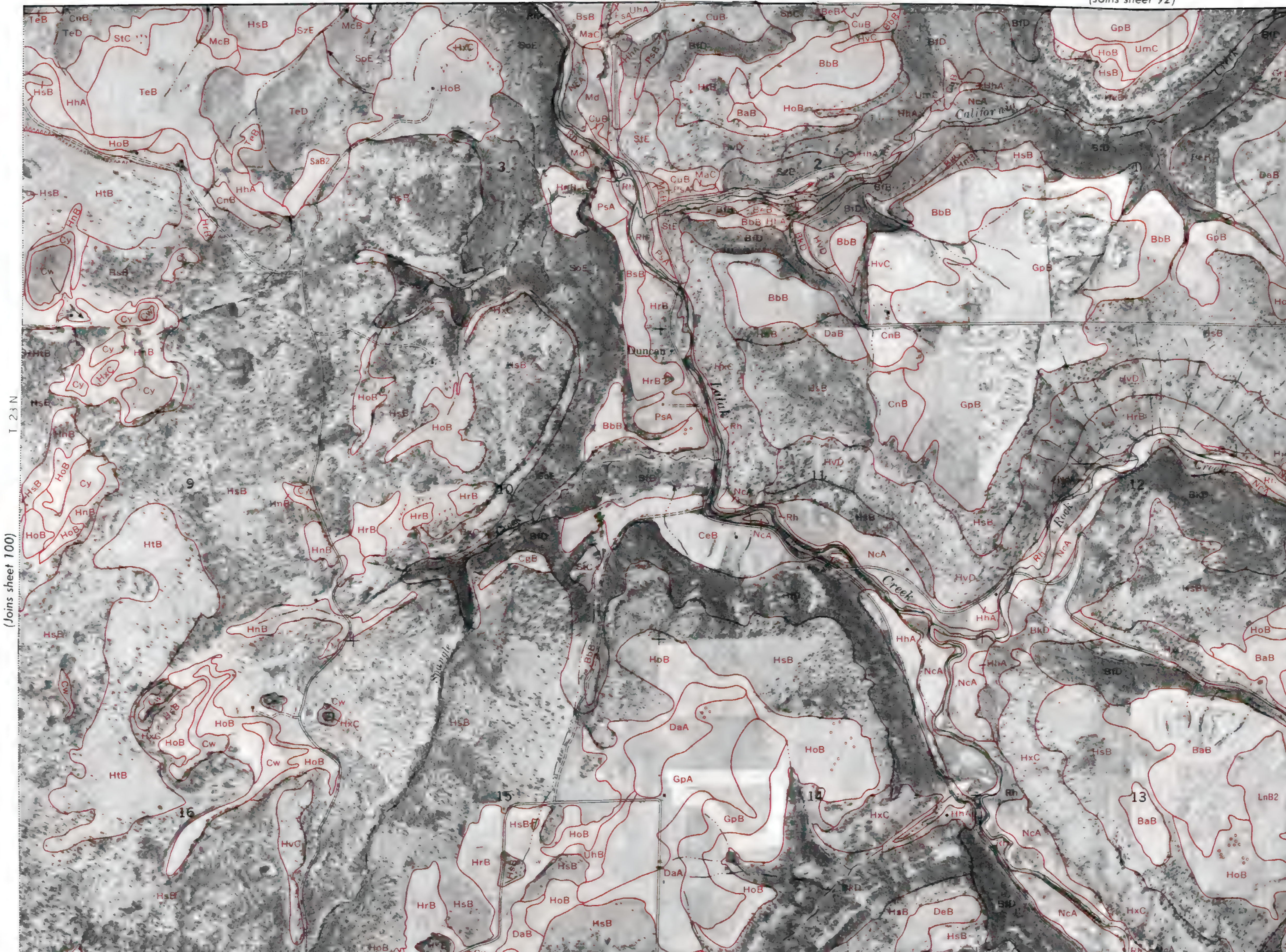
101

R. 43 E.

(Joins sheet 92)

T. 23 N.

(Joins sheet 100)



(Joins sheet 102)

(Joins sheet 110)

N

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

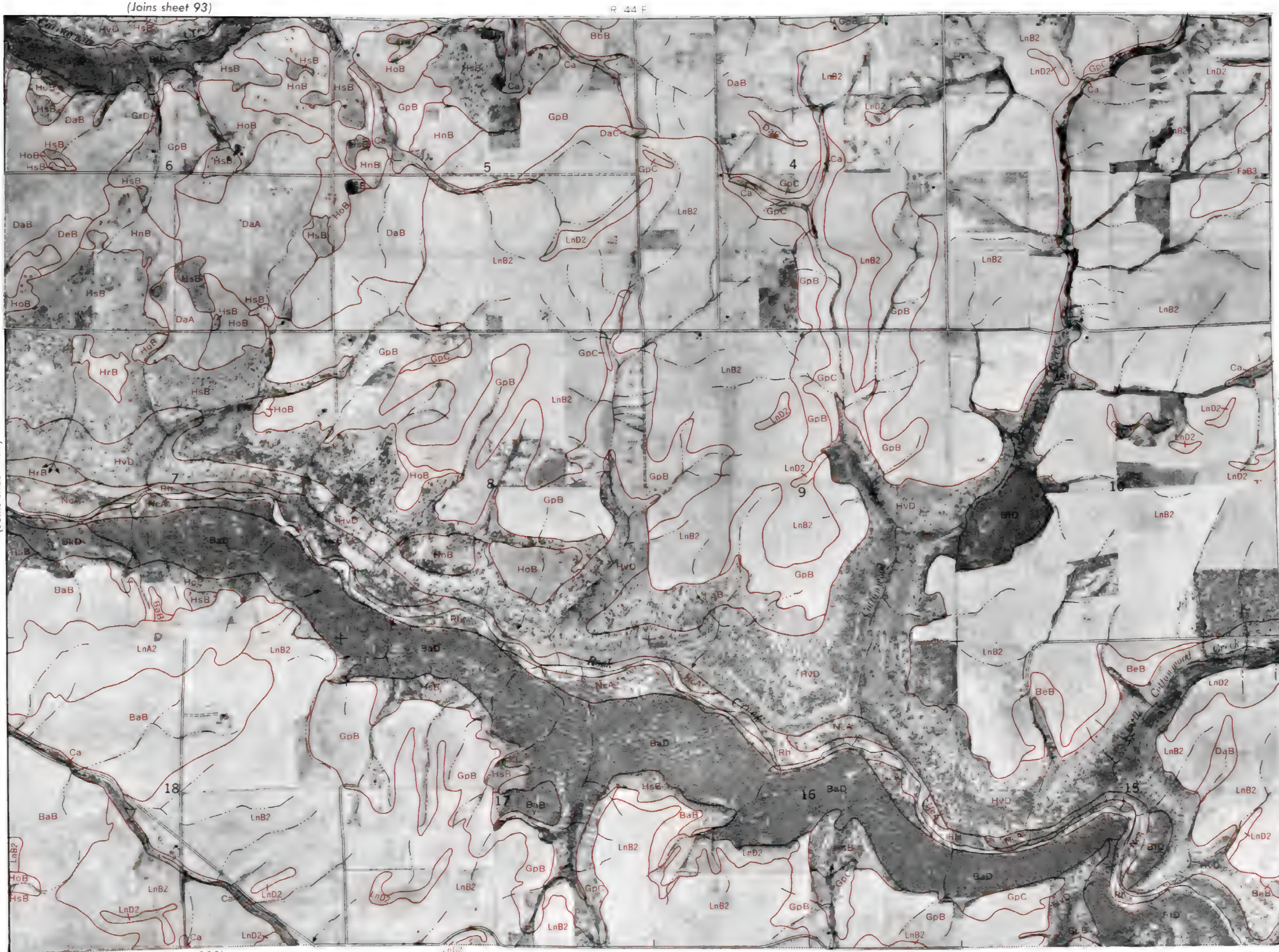
Range, township, and section corners shown on this map are indefinite.

102

(Joins sheet 93)

R. 44 E.

(Joins sheet 101)

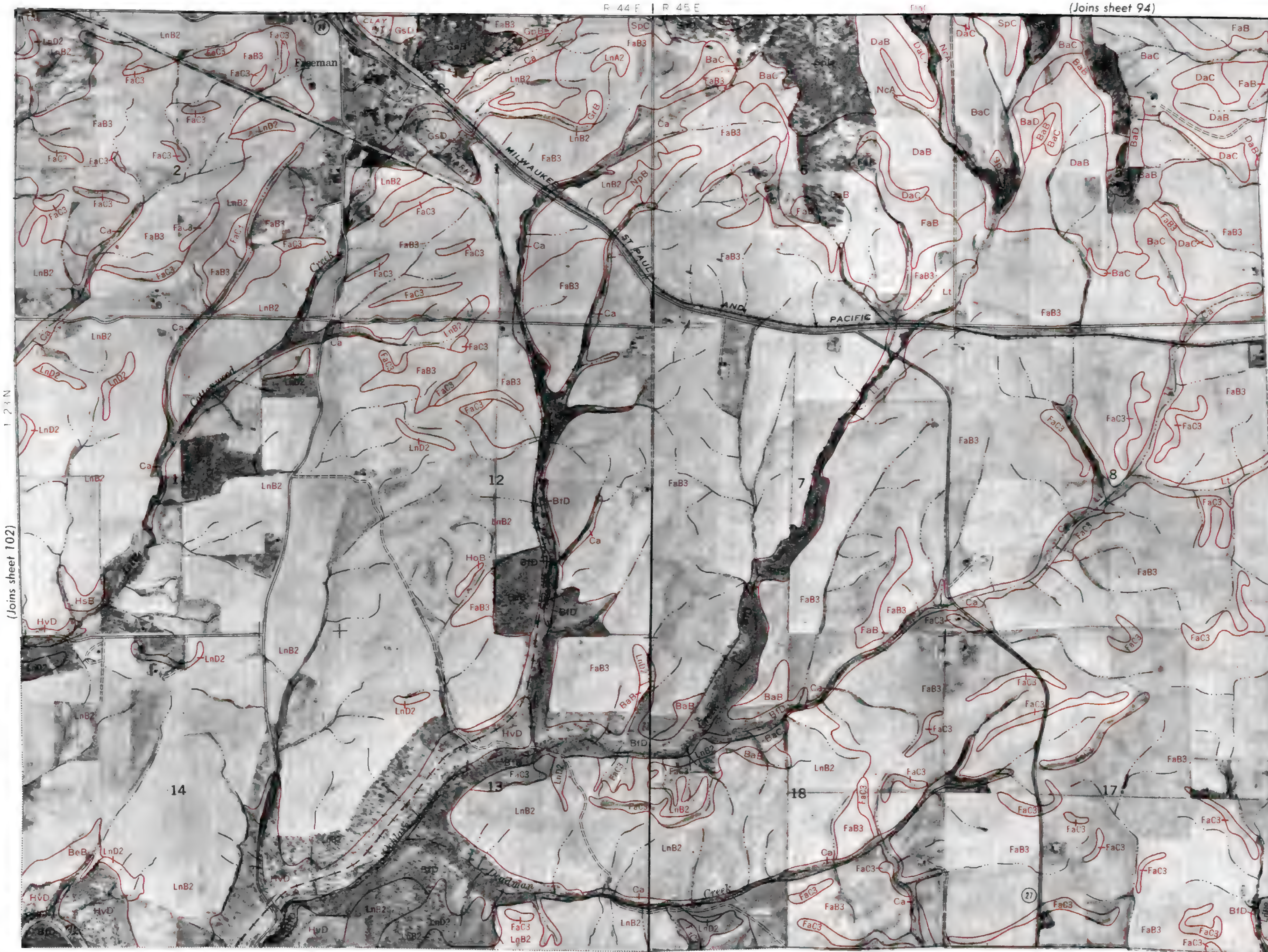


T. 23 N.

(Joins sheet 103)

(Joins sheet 111)

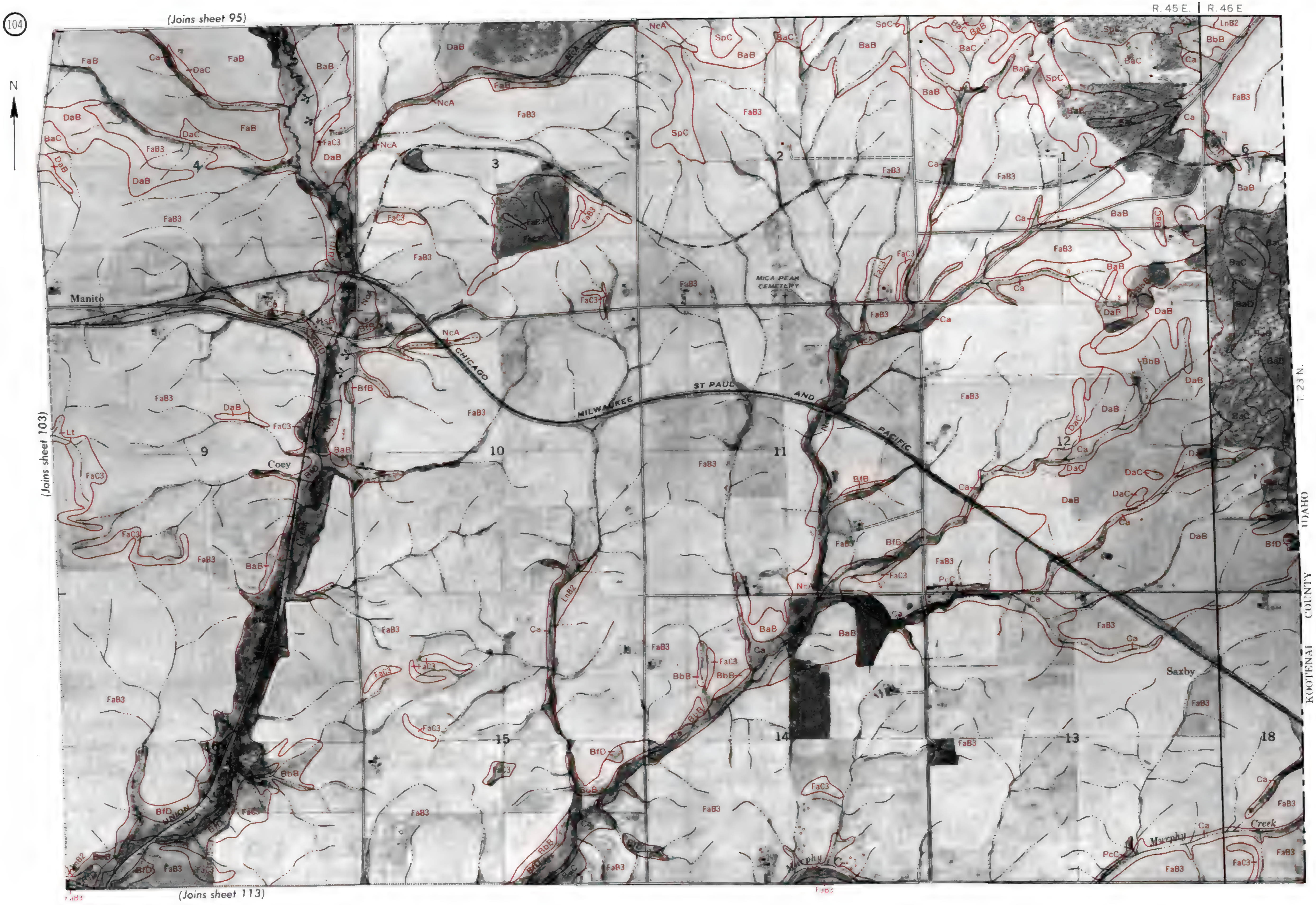
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



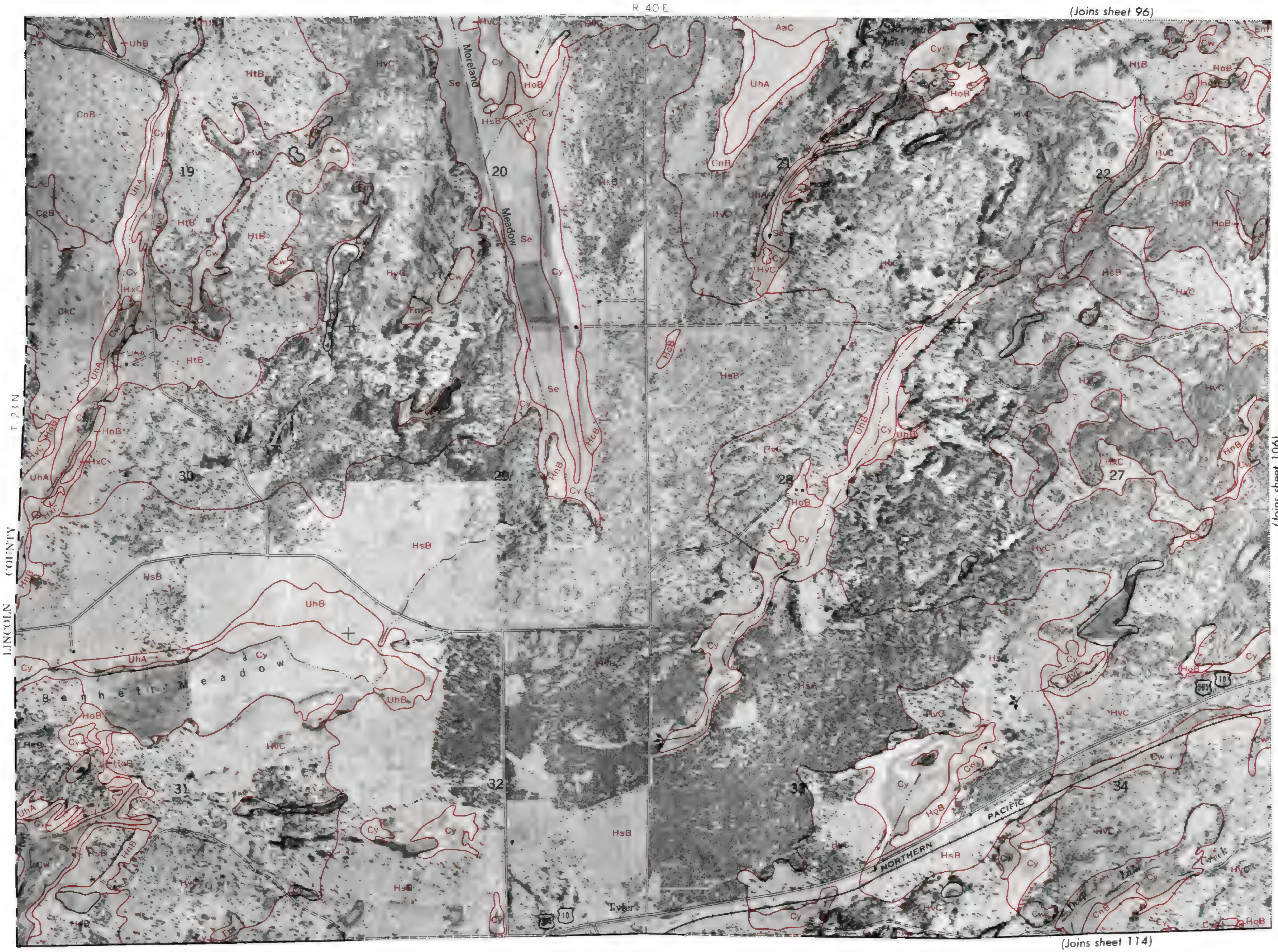
½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



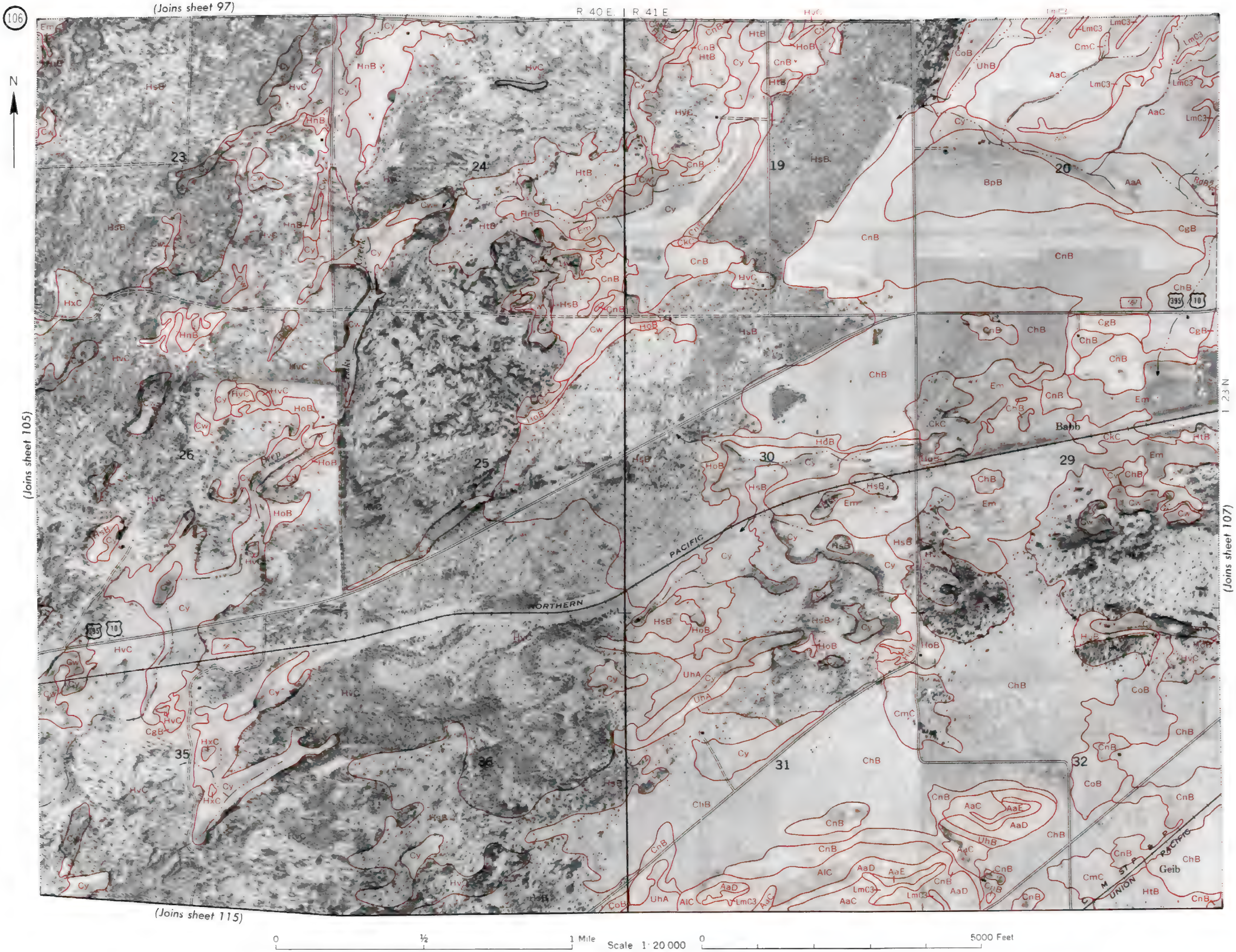
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

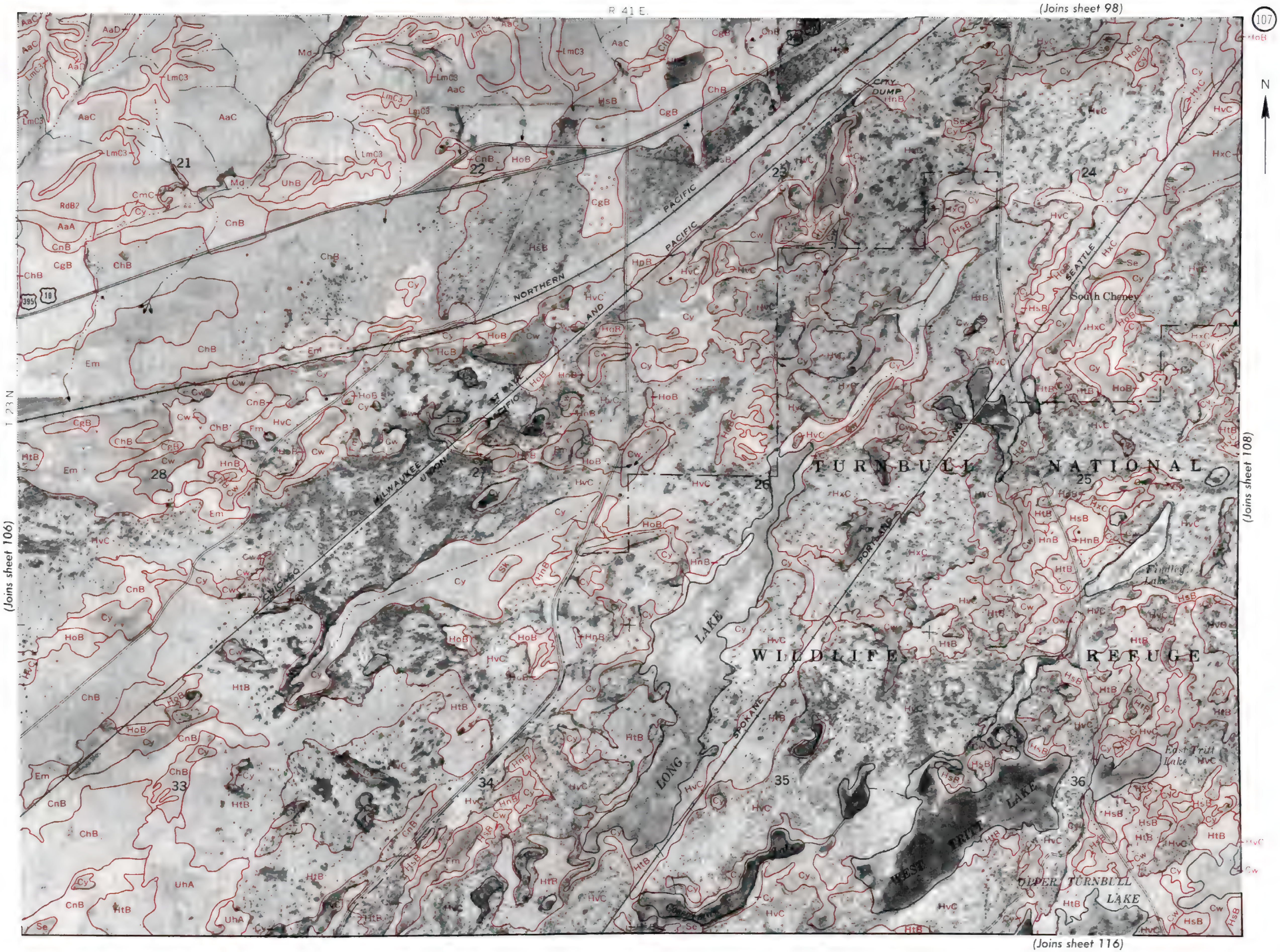


This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

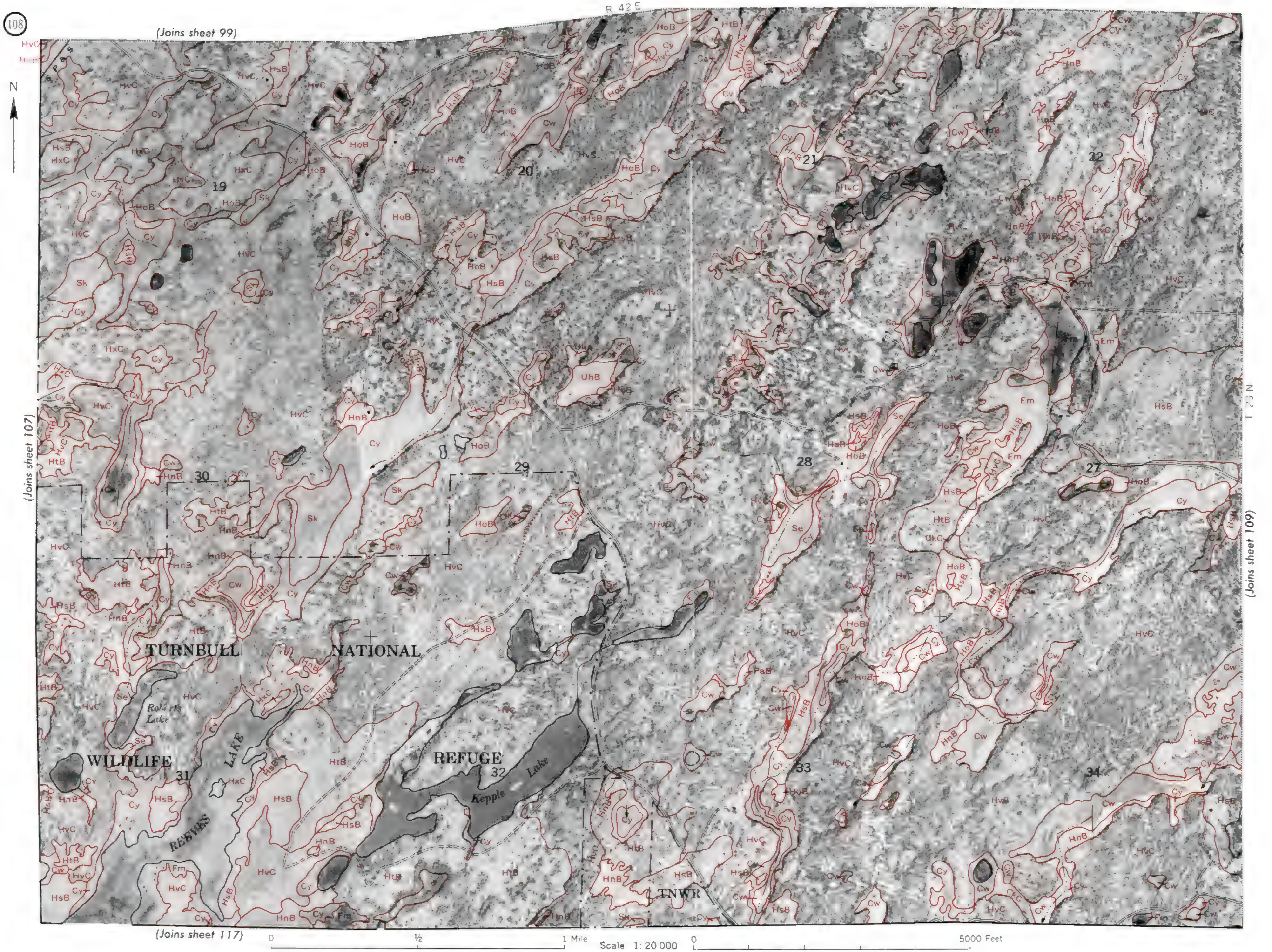

106
(Joins sheet 97)
(Joins sheet 105)
(Joins sheet 107)
(Joins sheet 115)
N
R 40 E. | R 41 E.
T. 23 N.
23
24
19
20
26
25
30
29
35
36
31
32
Babb
Geib
NORTHERN
PACIFIC
UNION
PACIFIC
395
10
HsB
HvC
HnB
Cy
Cw
HtB
CnB
HoB
HxC
Em
BpB
AaC
AaA
CgB
ChB
CmC
LmC3
UhB
CoB
CkC
UhA
CgB
AaE
AaD
AlC
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



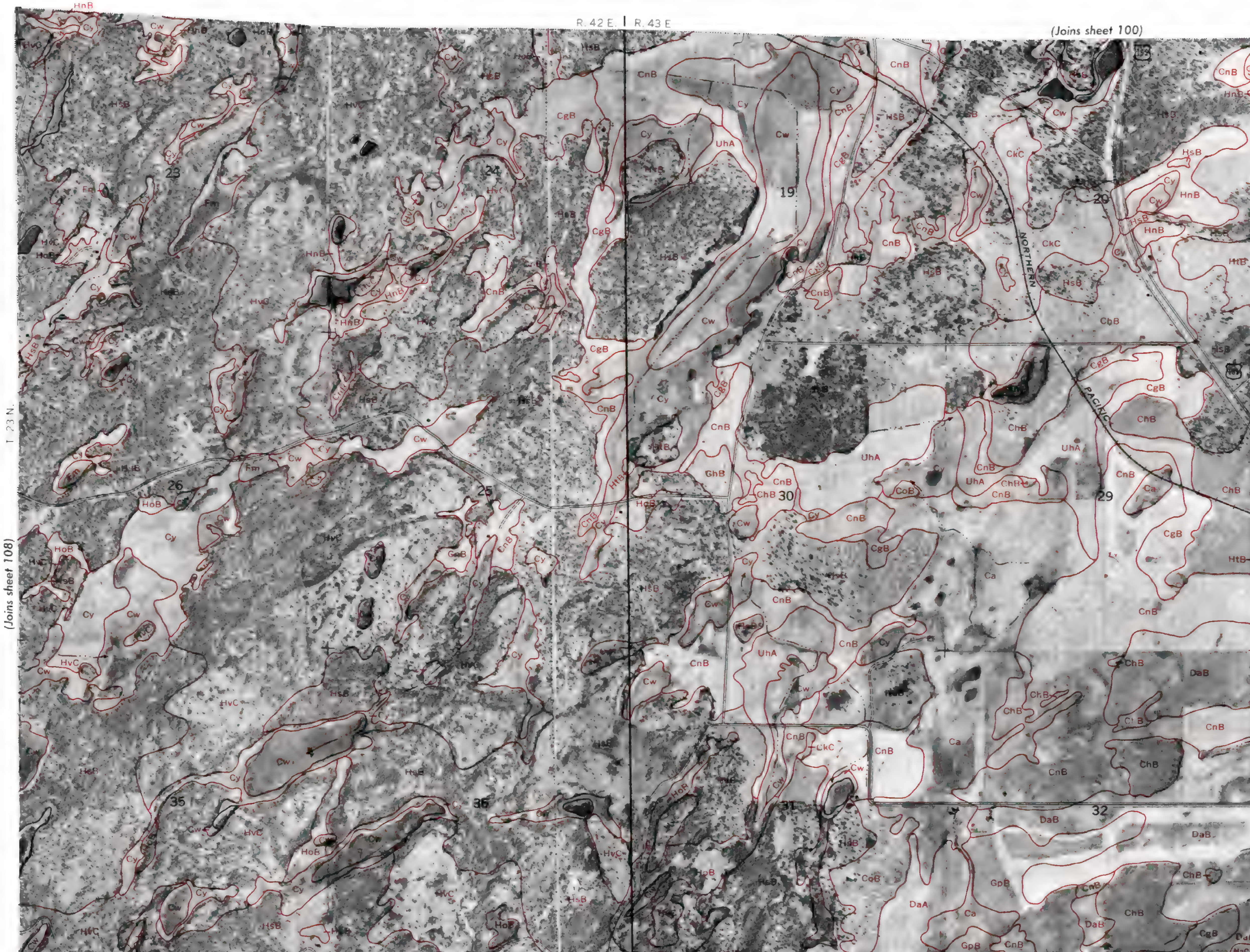
1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


108
(Joins sheet 99)
R 42 E
N
(Joins sheet 107)
(Joins sheet 109)
T 23 N
19
20
21
22
27
28
29
30
31
32
33
34
TURNBULL
NATIONAL
WILDLIFE
REFUGE
Roberts Lake
LAKE
REEVES
Kepple Lake
TNWR
(Joins sheet 117)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 109



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

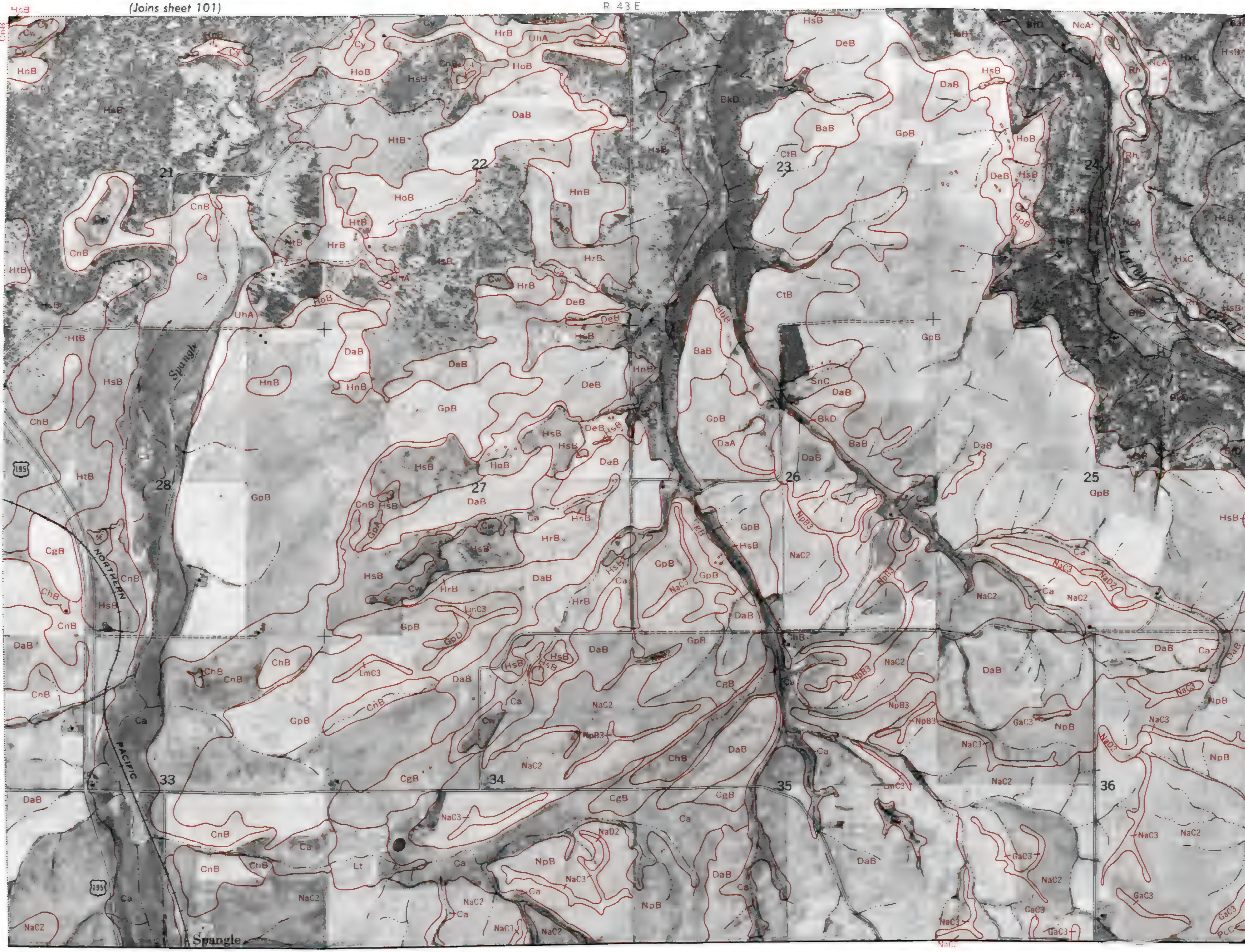
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite

110

(Joins sheet 101)

R. 43 E.



(Joins sheet 109)

(Joins sheet 111)

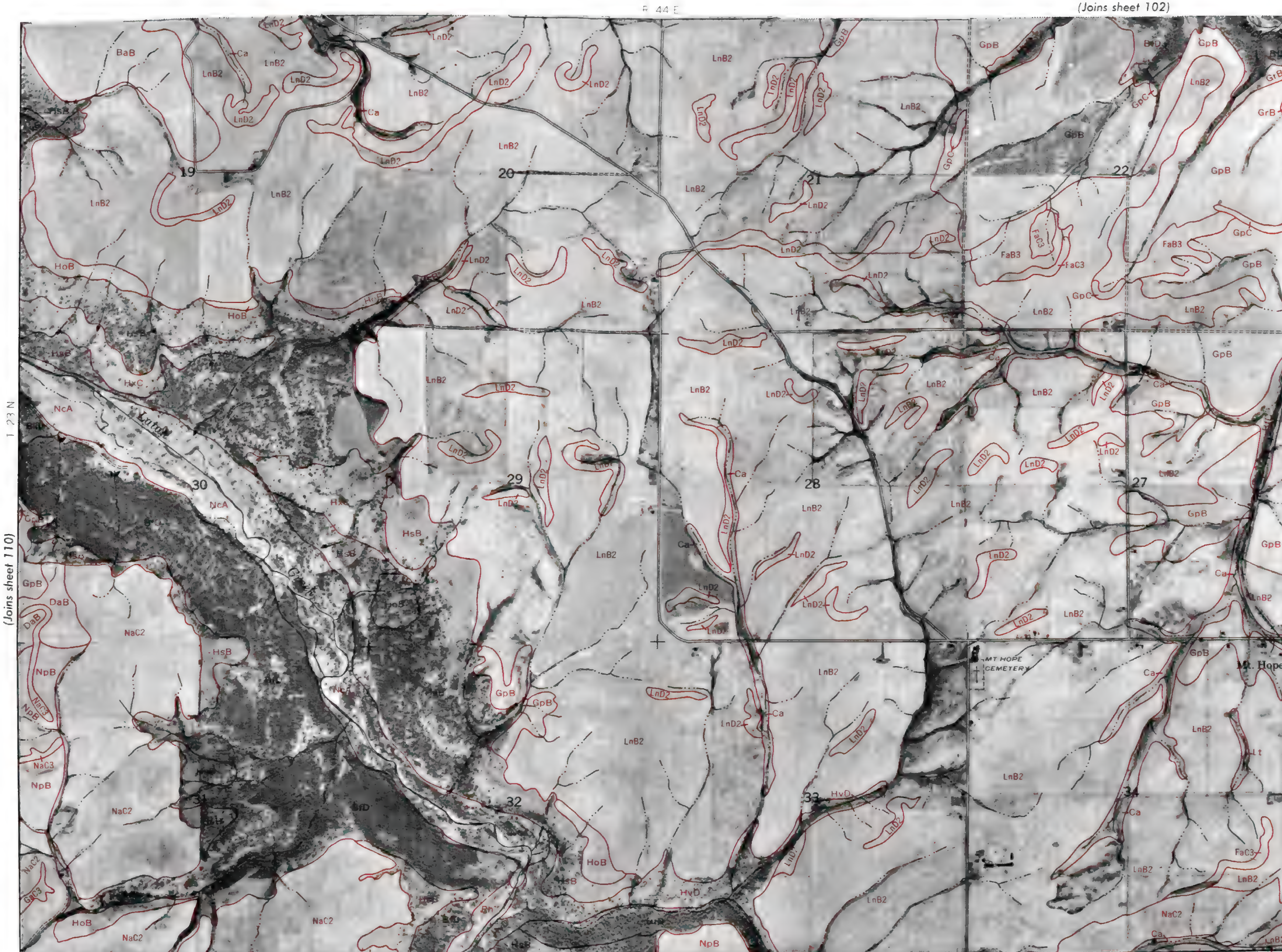
(Joins sheet 119)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

R. 44 E.

(Joins sheet 102)

111



(Joins sheet 110)

(Joins sheet 112)

(Joins sheet 120)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

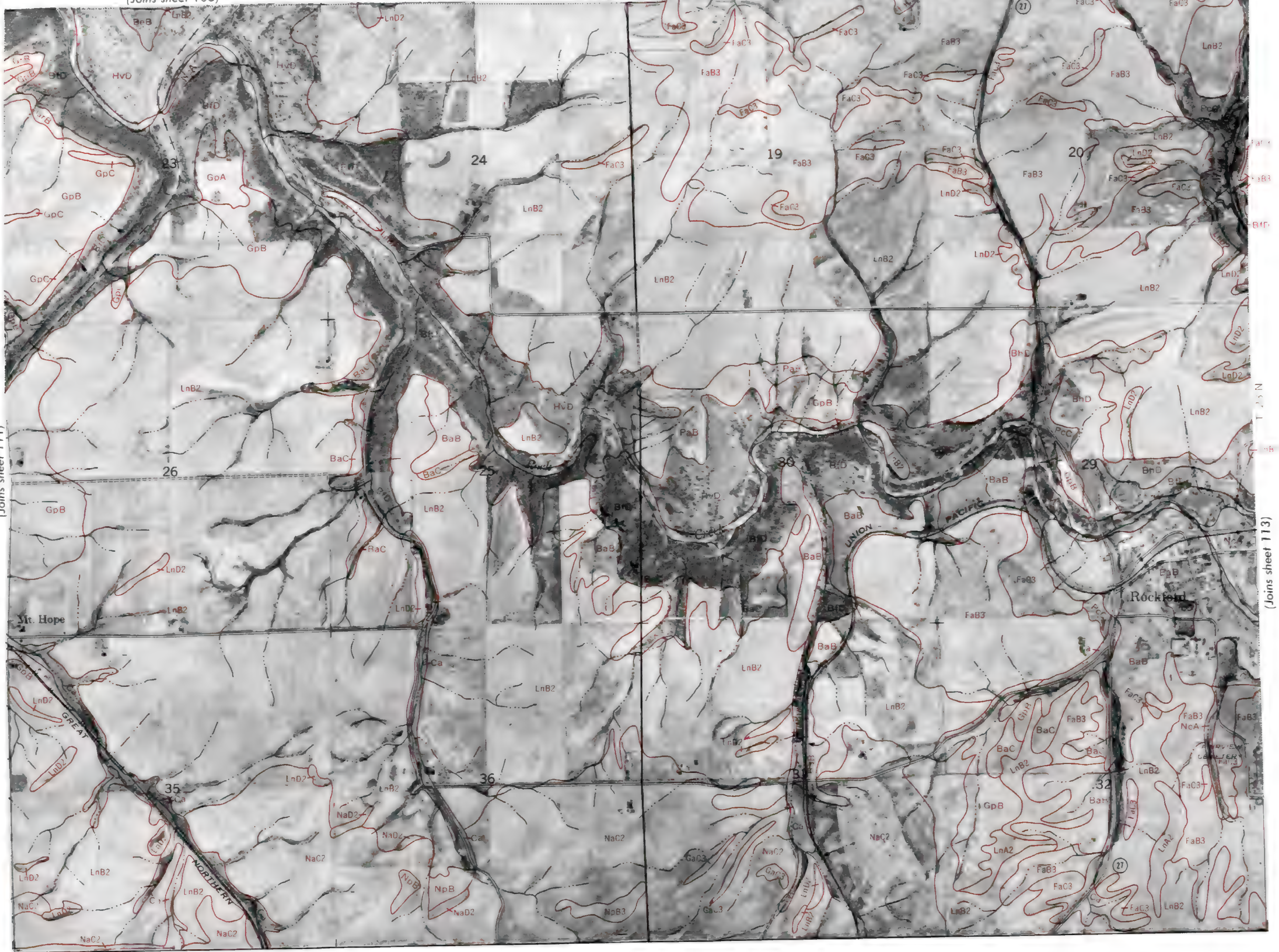
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

112

(Joins sheet 103)

R 44 E | R 45 E

(Joins sheet 111)



(Joins sheet 113)

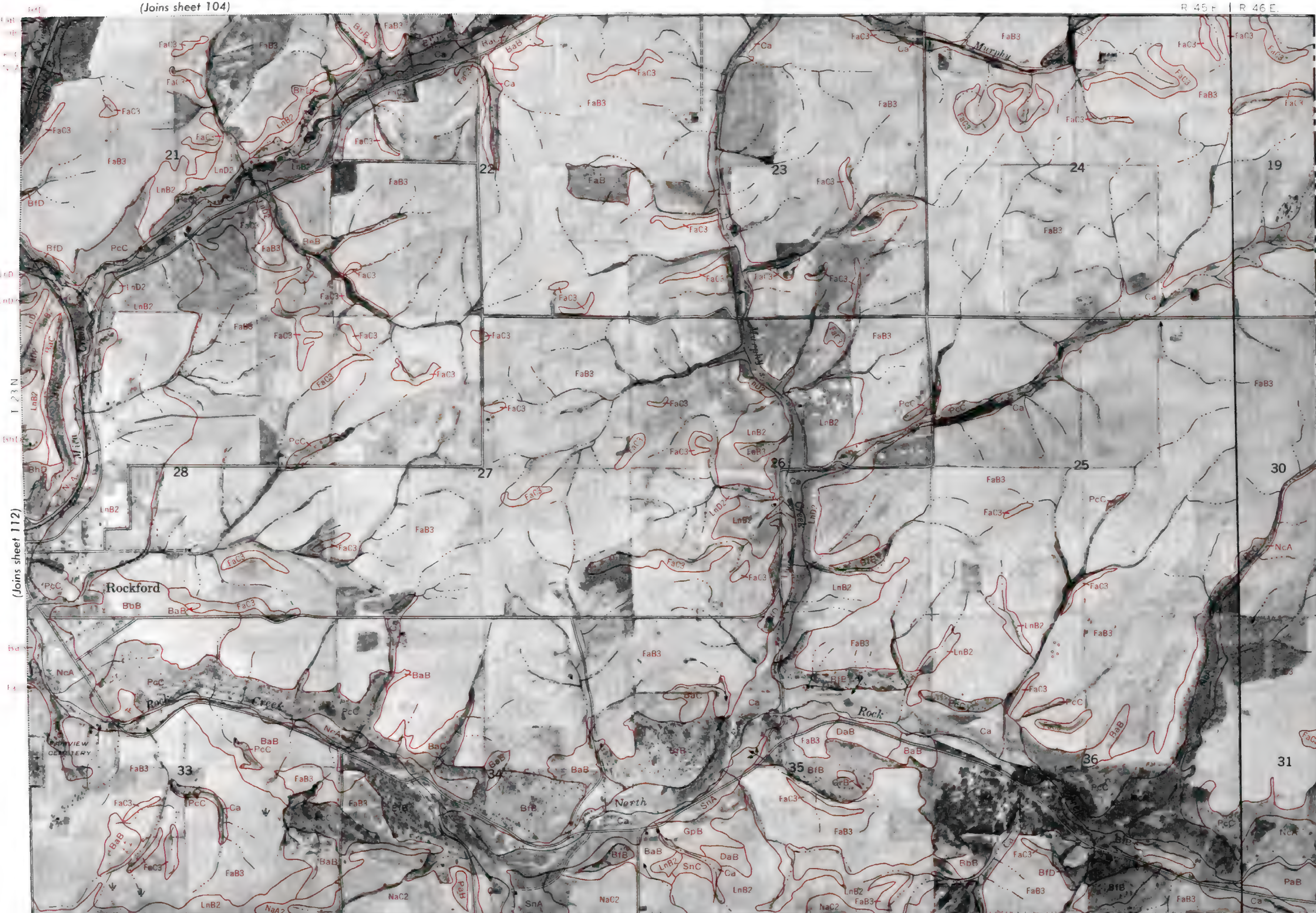
(Joins sheet 121)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 104)

R 45 E. | R 46 E.

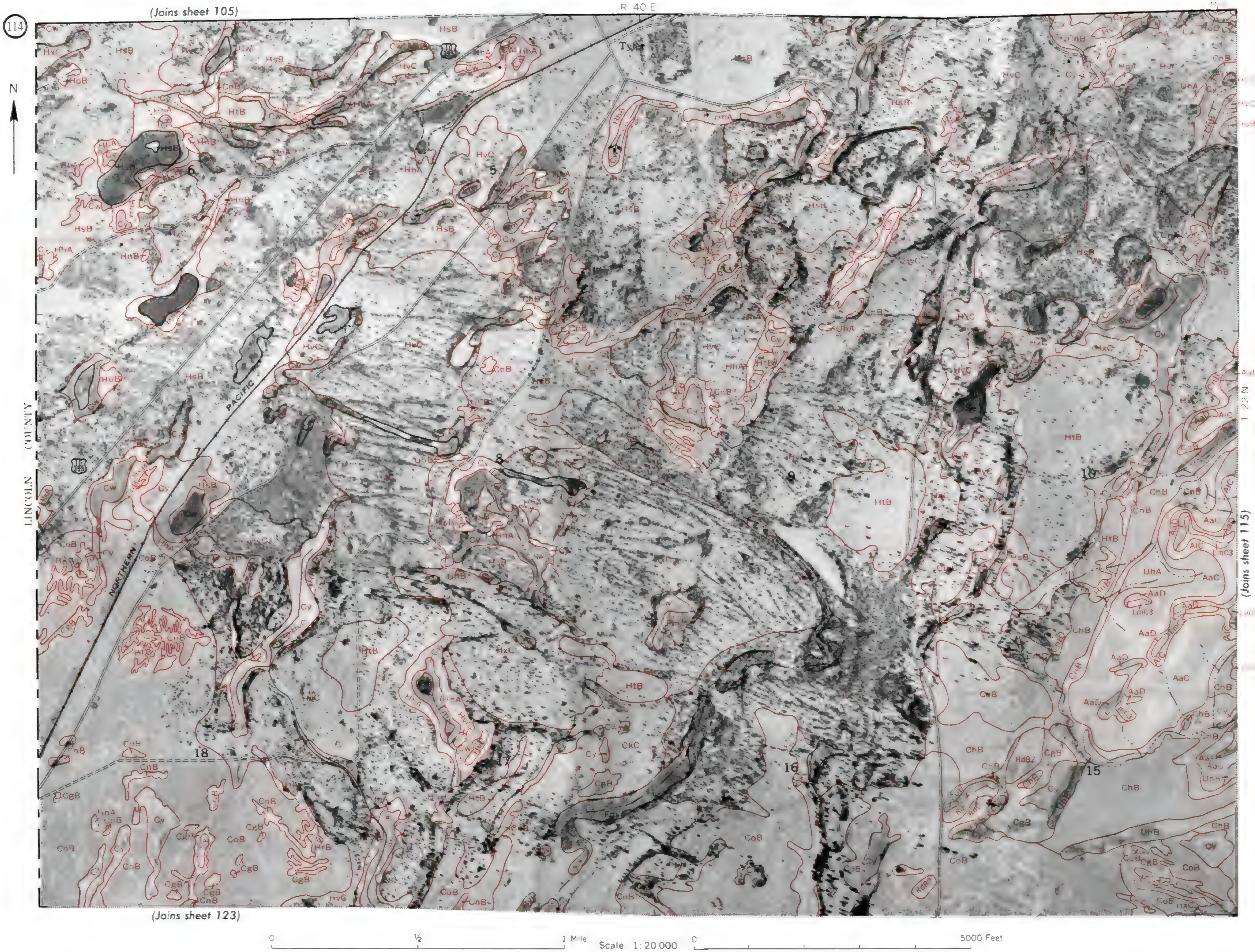
113



(Joins sheet 112)

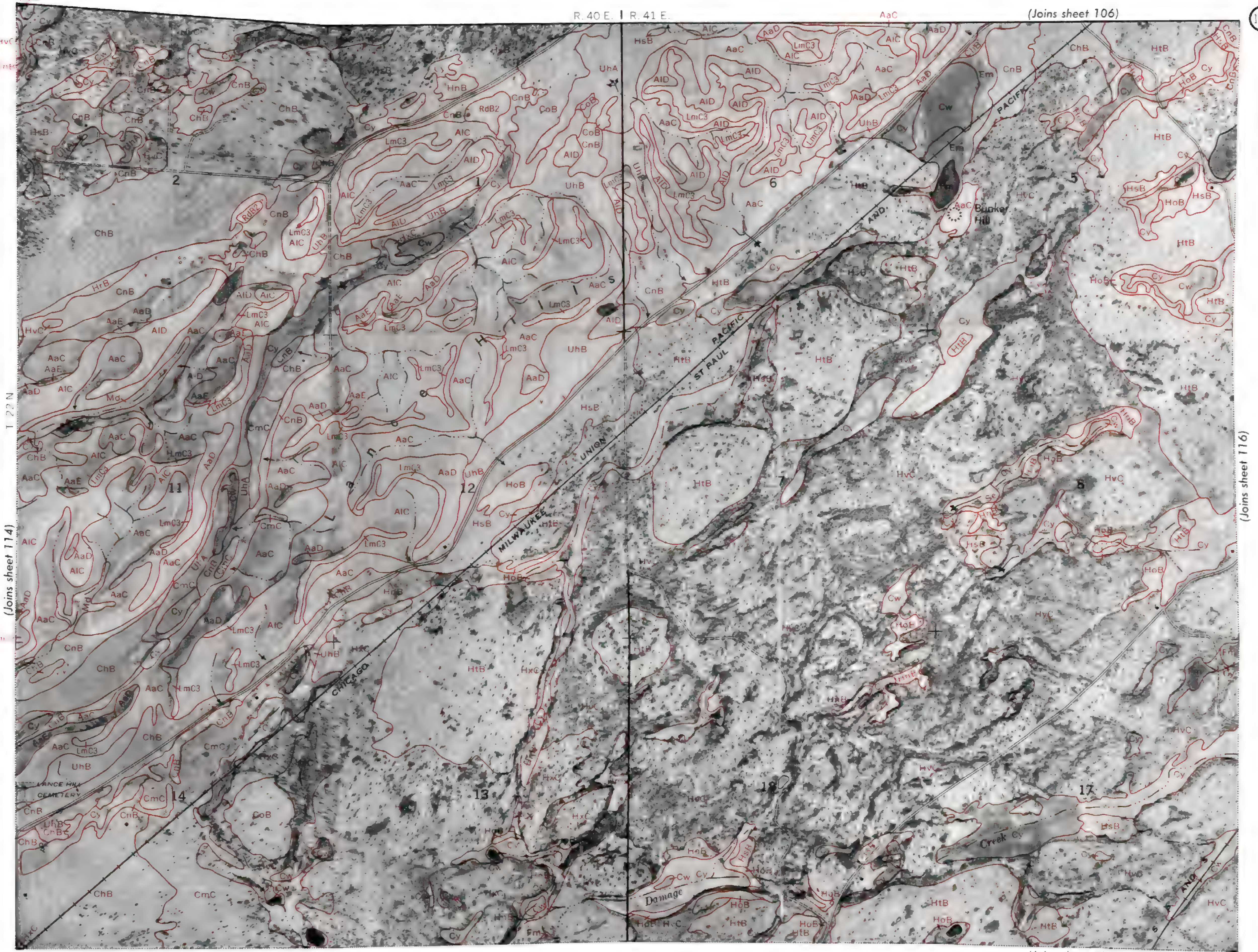
(Joins sheet 122)

1 Mile ½ 0 Scale 1:20 000 0 5000 Feet

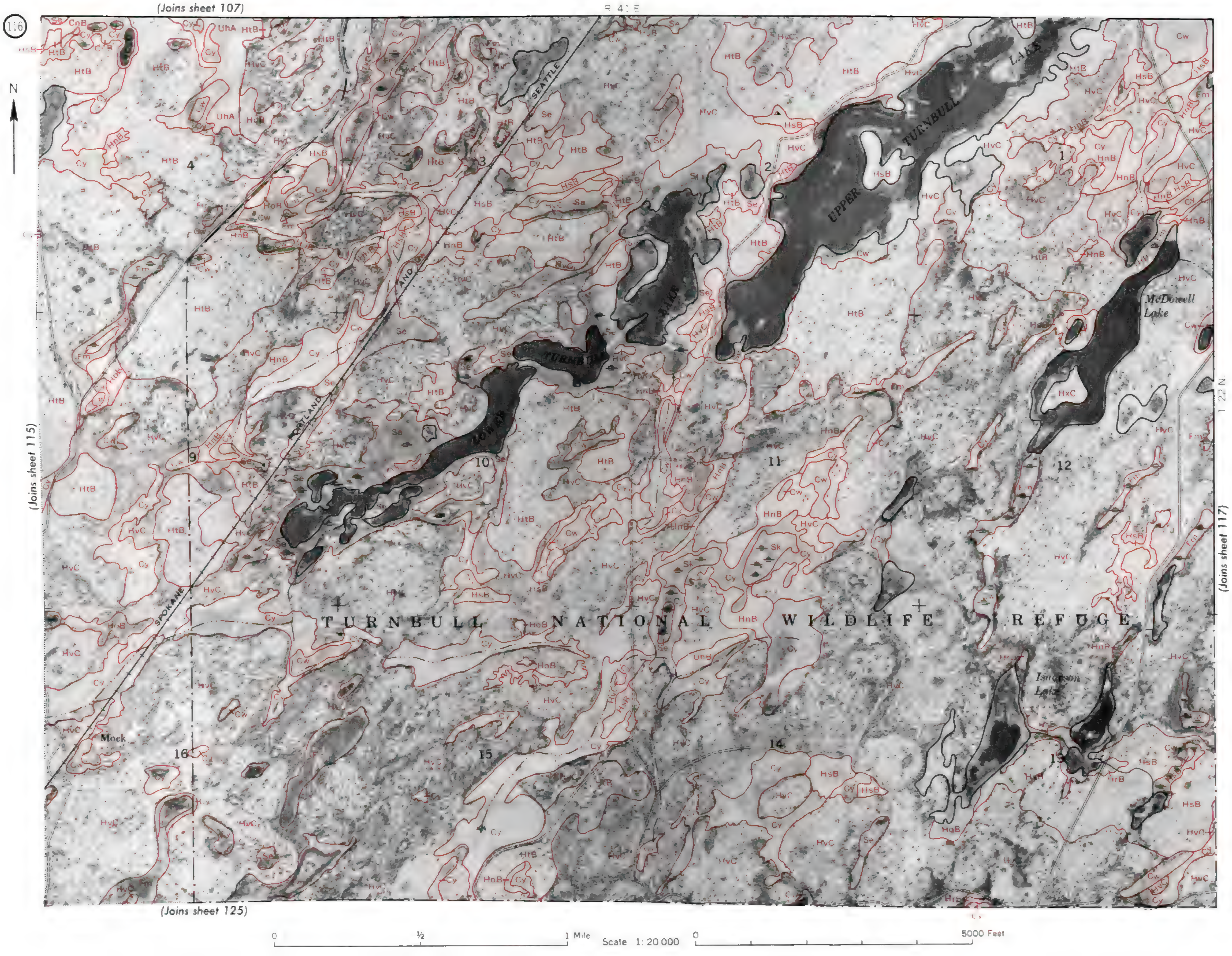

114
(Joins sheet 105)
R 40 E
N
Tyler
LINCOLN COUNTY
NORTHERN PACIFIC
T 22 N
(Joins sheet 115)
(Joins sheet 123)
Scale 1:20 000
0
½
1 Mile
0
5000 Feet

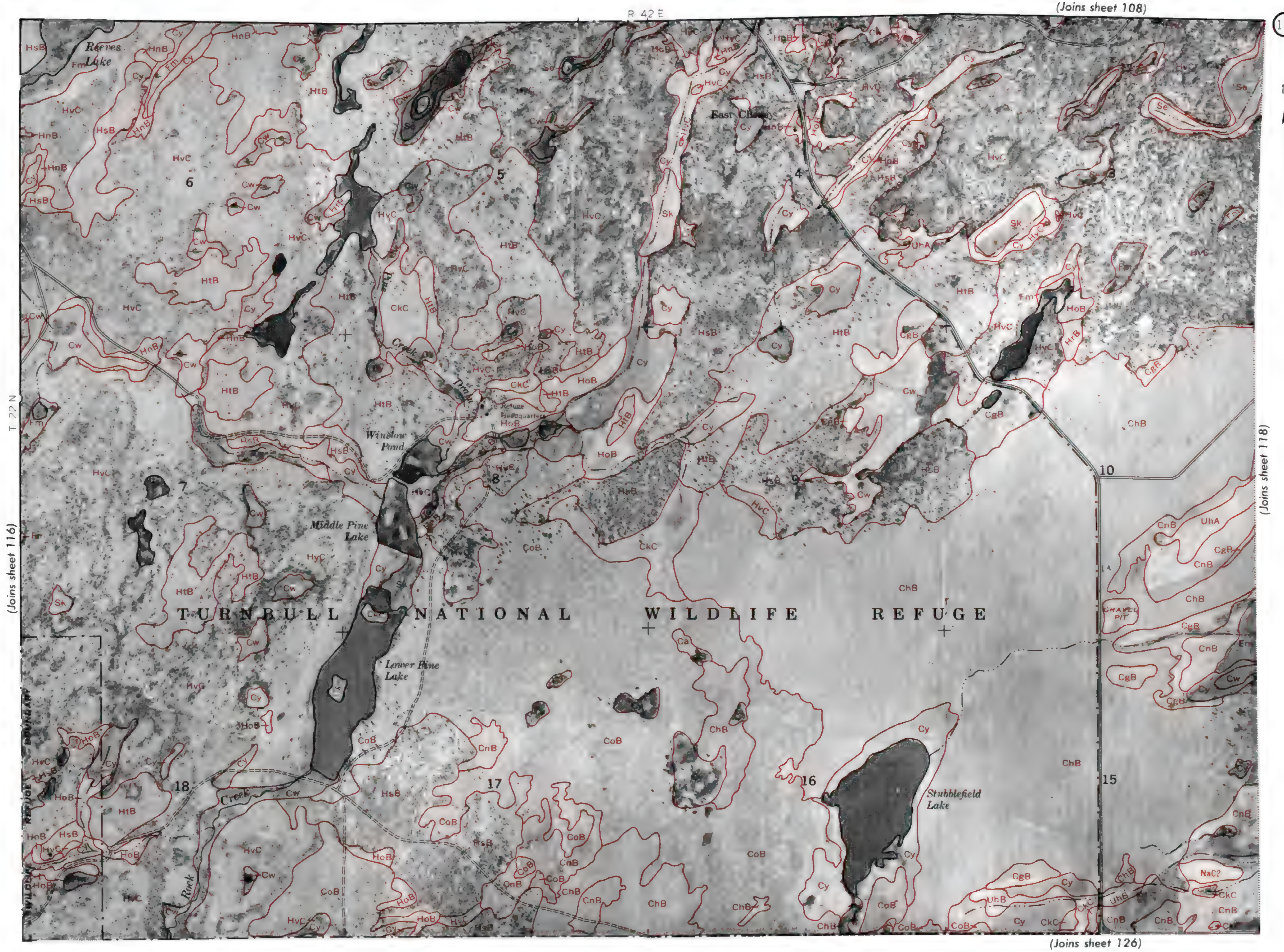
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

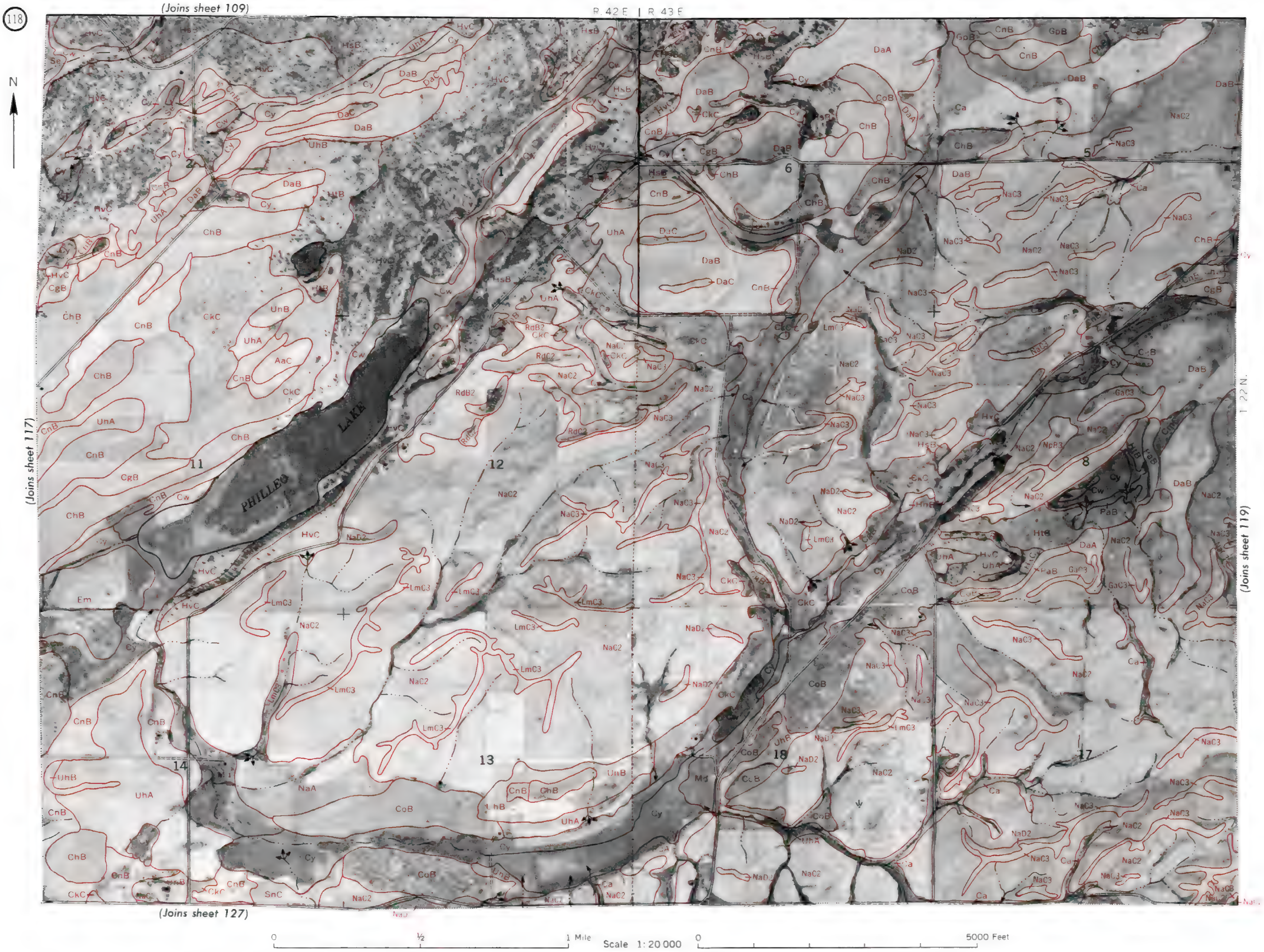

116
(Joins sheet 107)
R 41 E
N
(Joins sheet 115)
(Joins sheet 117)
(Joins sheet 125)
T 22 N.
UPPER TURNBULL LAKE
LOWER TURNBULL LAKE
McDowell Lake
Isaacson Lake
SEATTLE AND PORTLAND SPOKANE
TURNBULL NATIONAL WILDLIFE REFUGE
Mock
1
2
3
4
9
10
11
12
13
14
15
16
HtB
HsB
HvC
HnB
HoB
Cy
Cw
Se
Sk
Fm
UhA
CnB
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



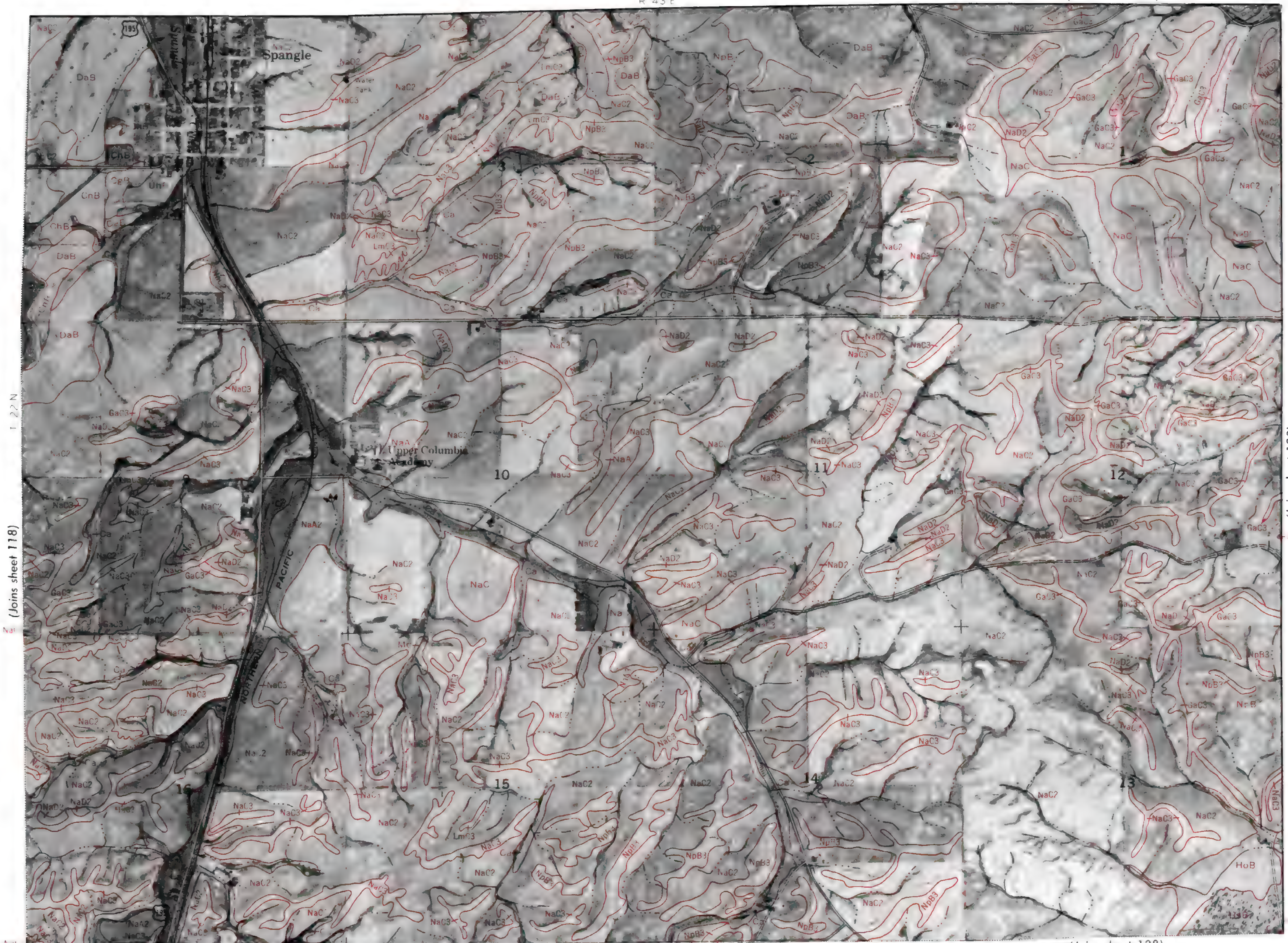
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


118
(Joins sheet 109)
R. 42 E. | R. 43 E.
N
(Joins sheet 117)
(Joins sheet 119)
(Joins sheet 127)
T. 22 N.
PHILLEO LAKE
1
2
5
6
7
8
11
12
13
14
17
18
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

(Joins sheet 110)



(Joins sheet 118)

(Joins sheet 120)

(Joins sheet 128)

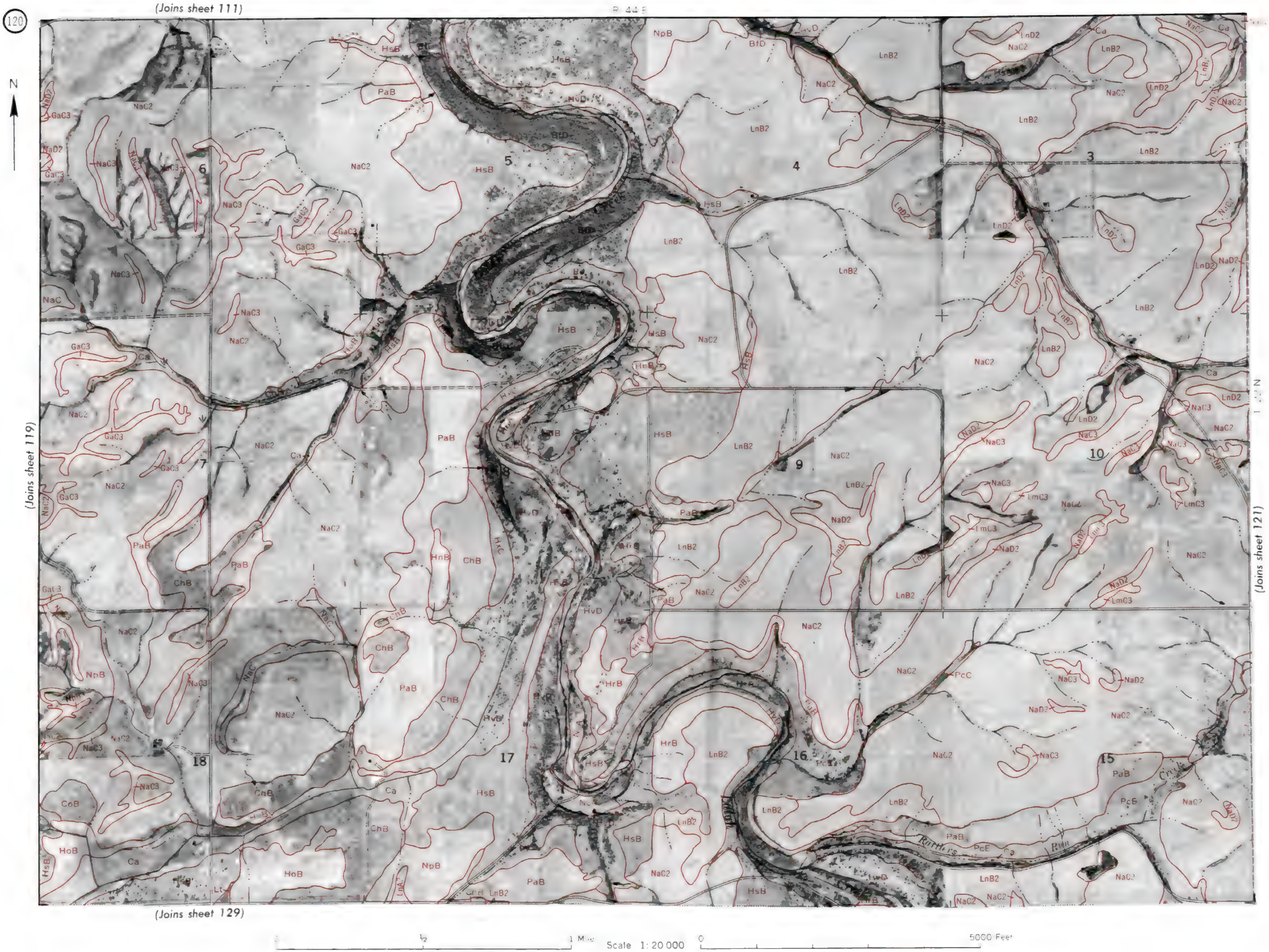
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 120



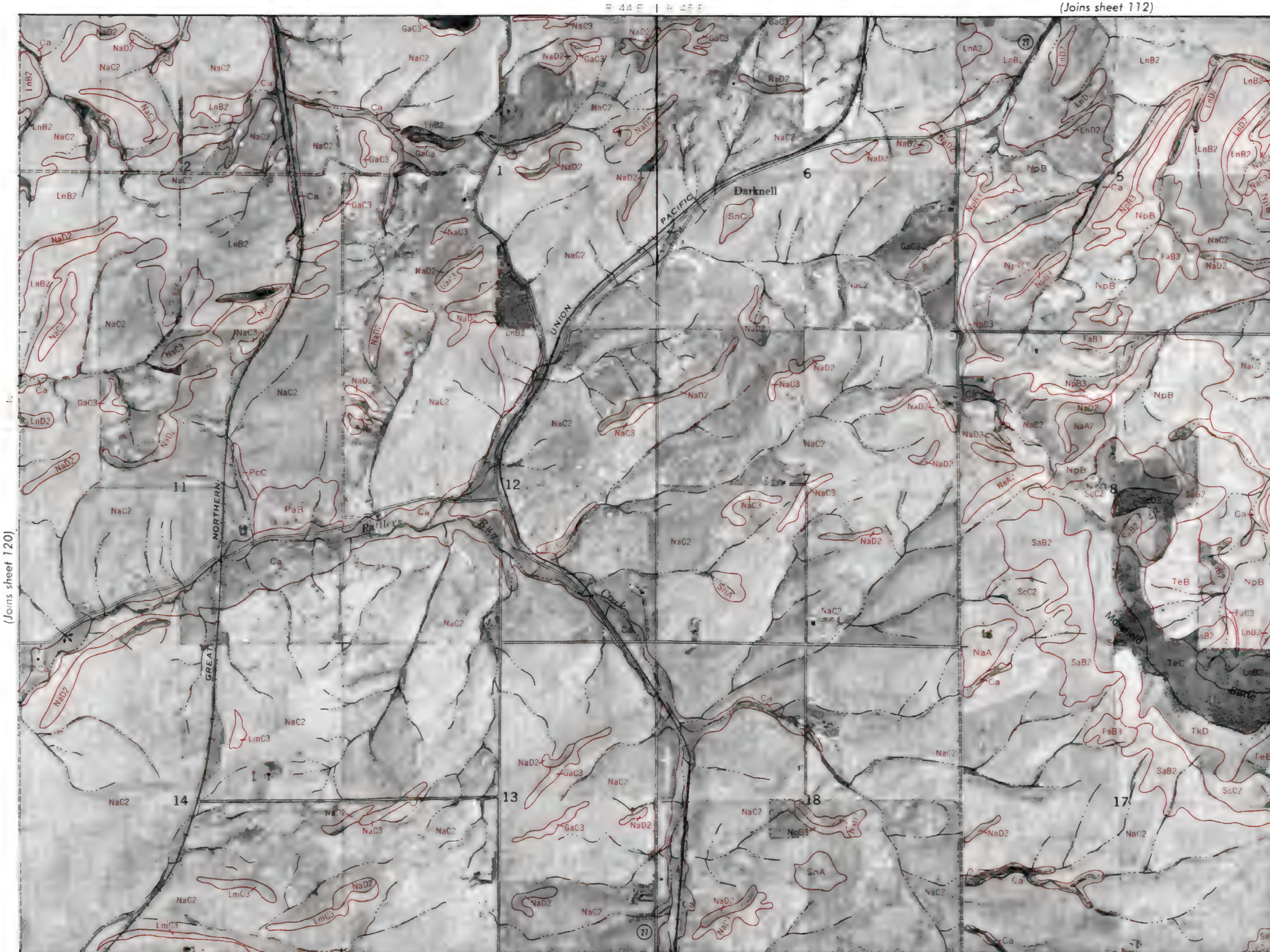
(Joins sheet 112)

121

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

(Joins sheet 120)

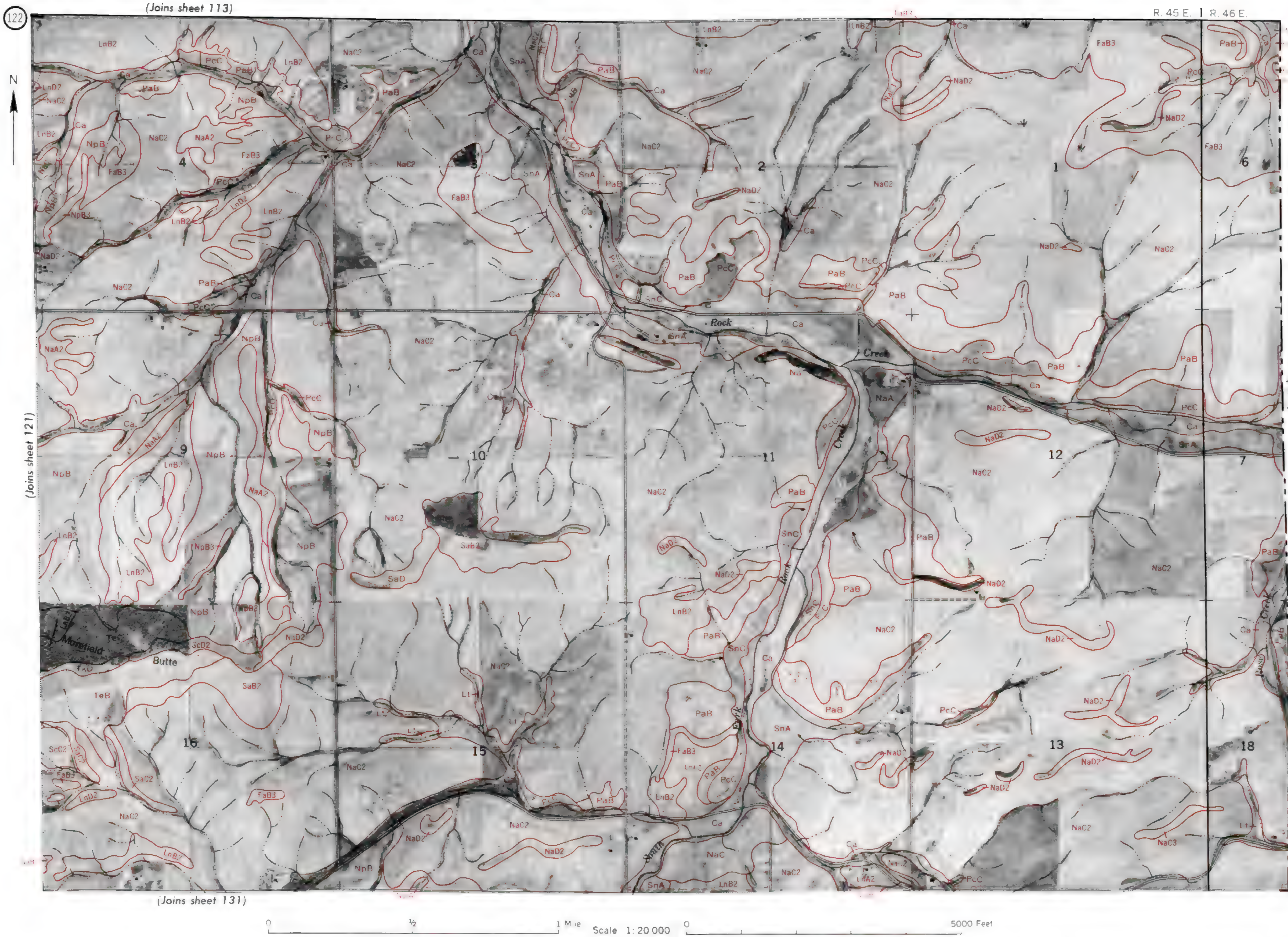


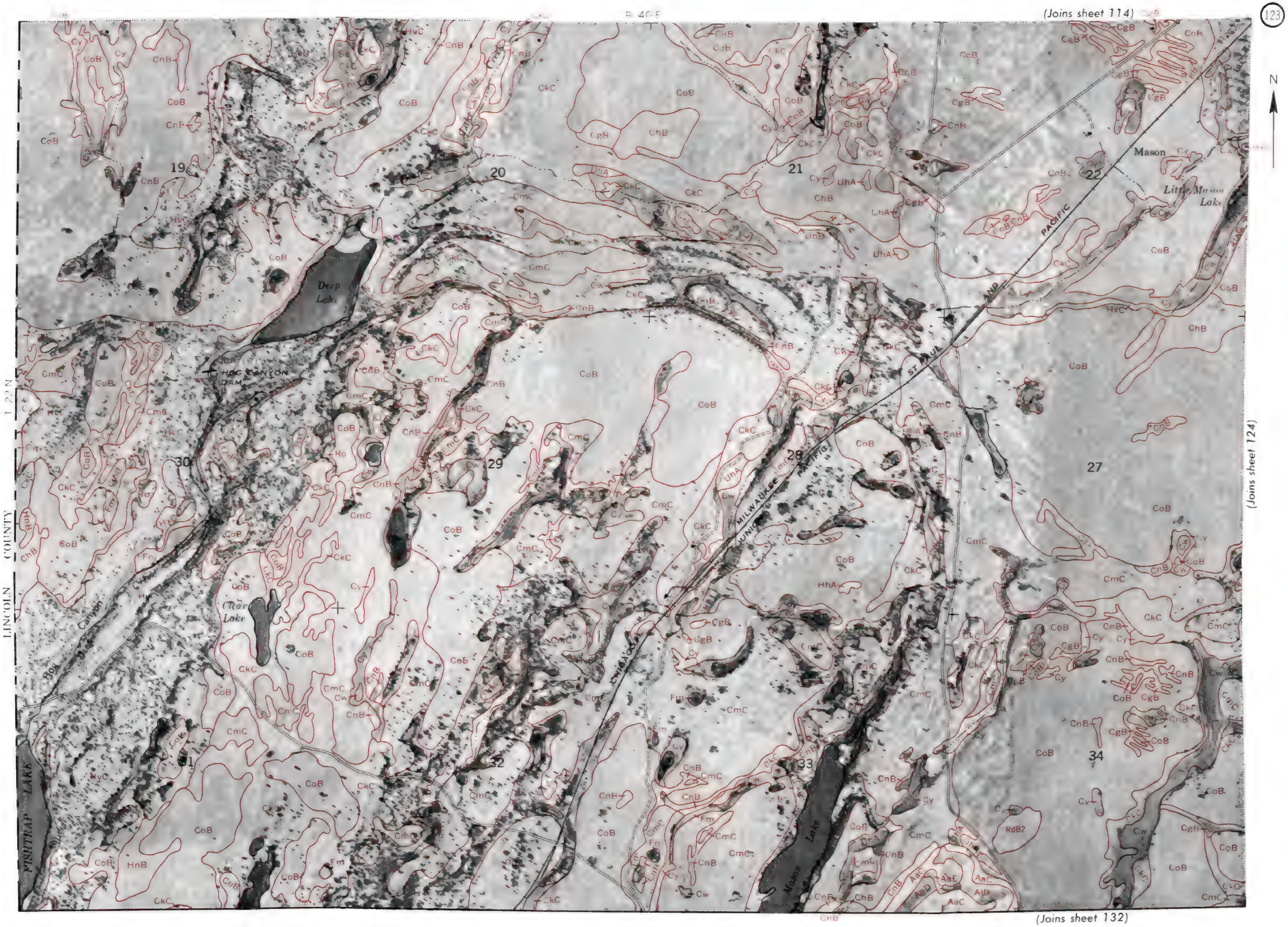
(Joins sheet 122)

(Joins sheet 130)

1 Mile Scale 1:20 000 0 5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 122

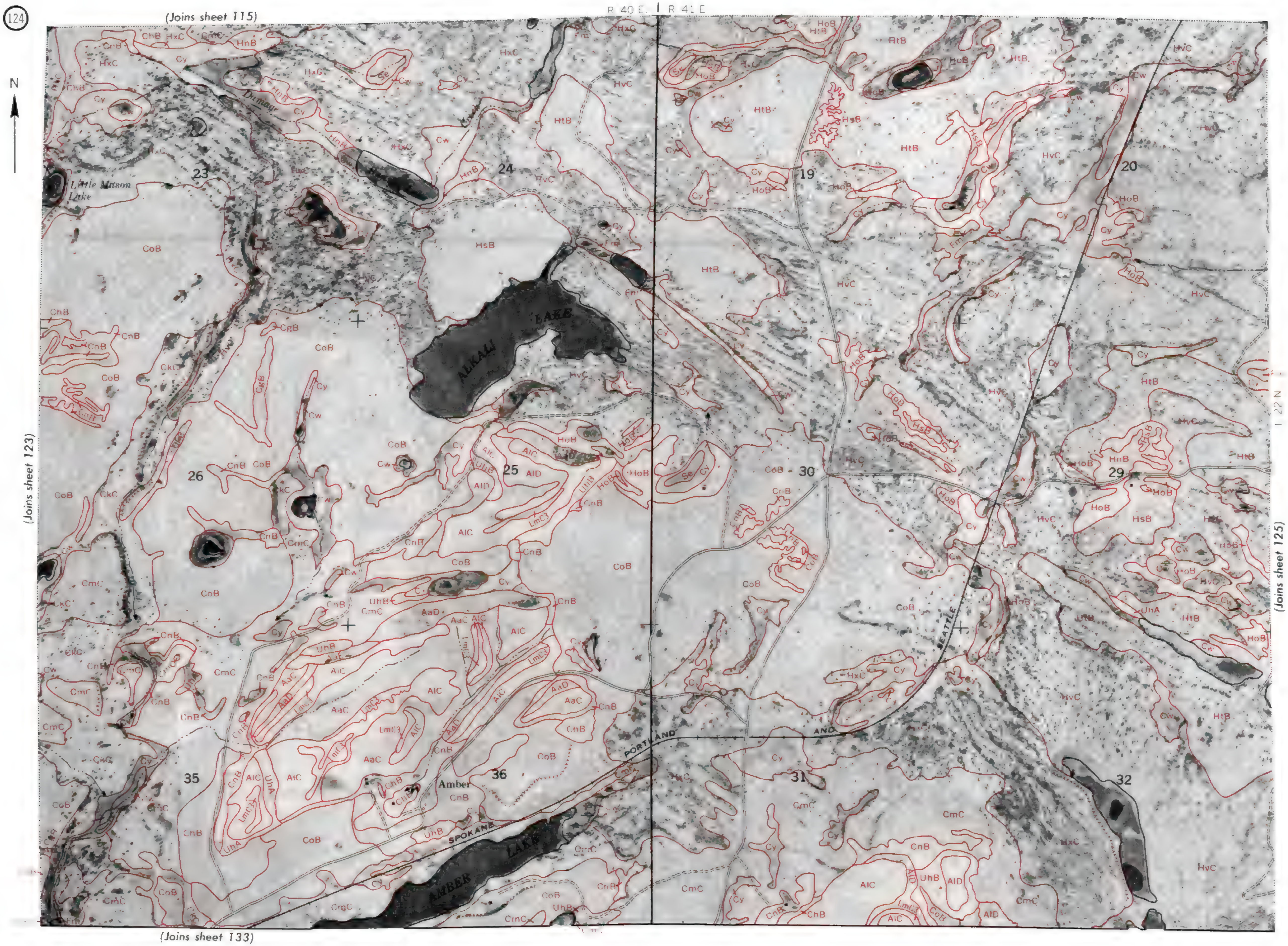




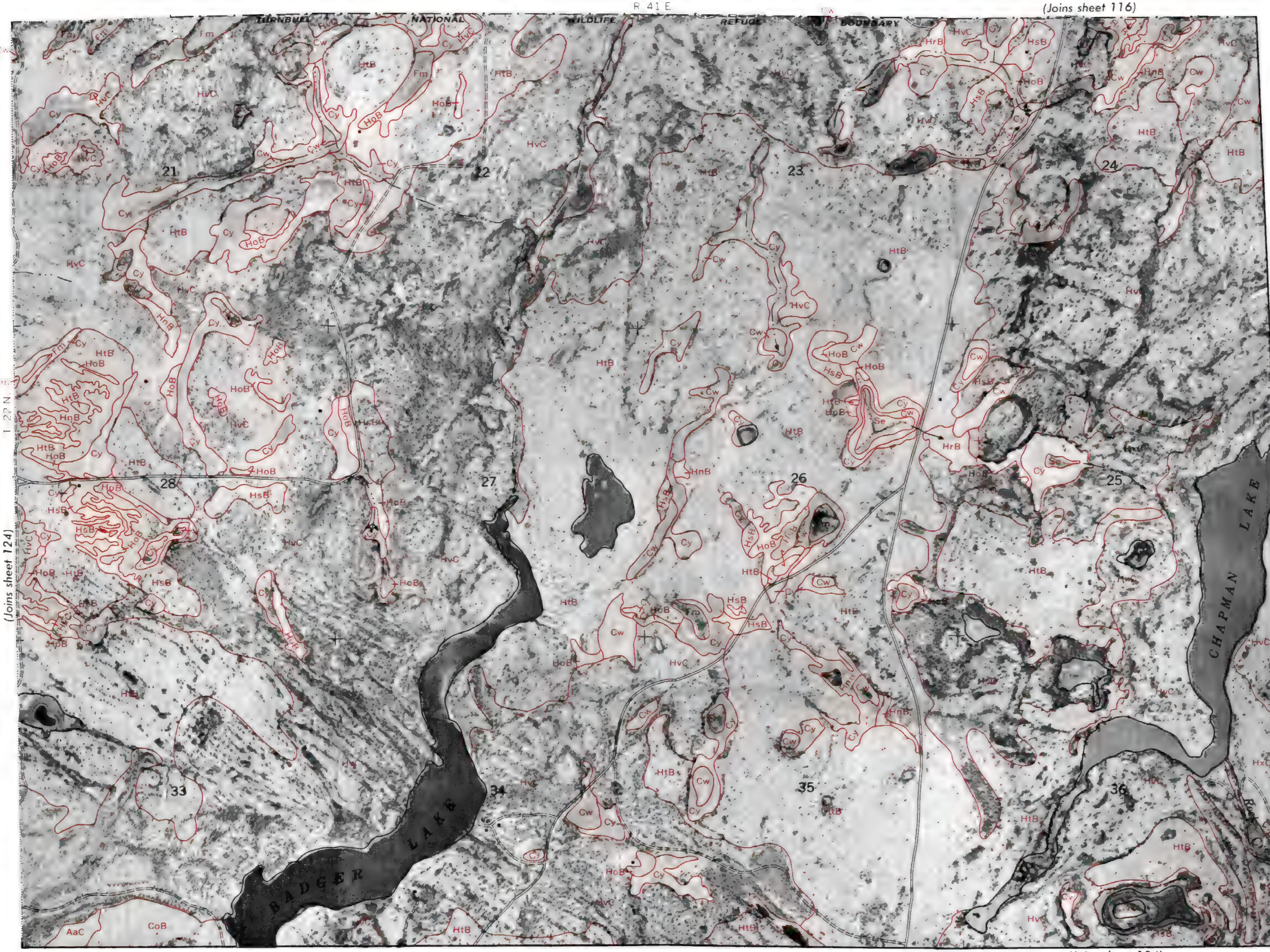
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



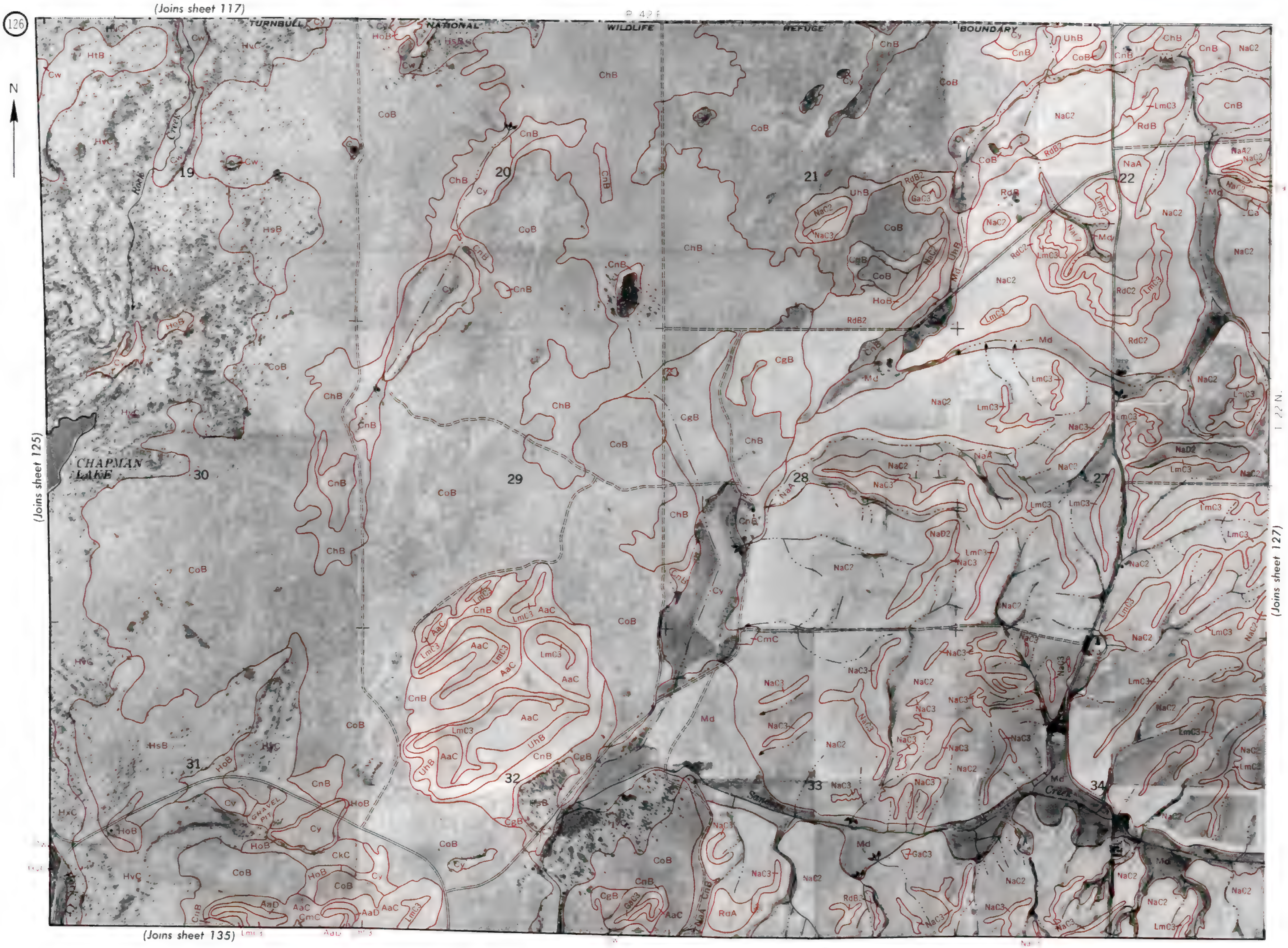
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

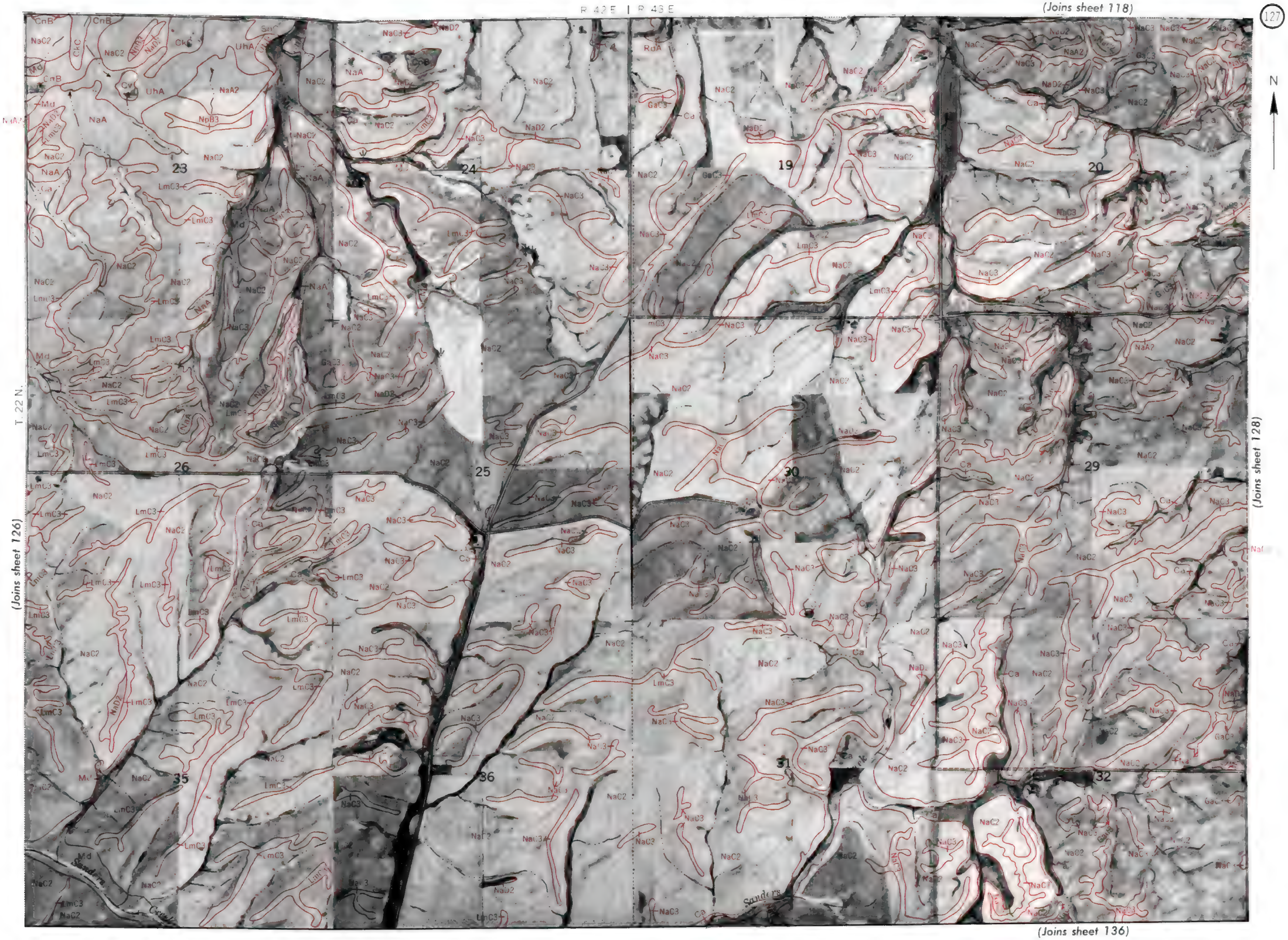
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

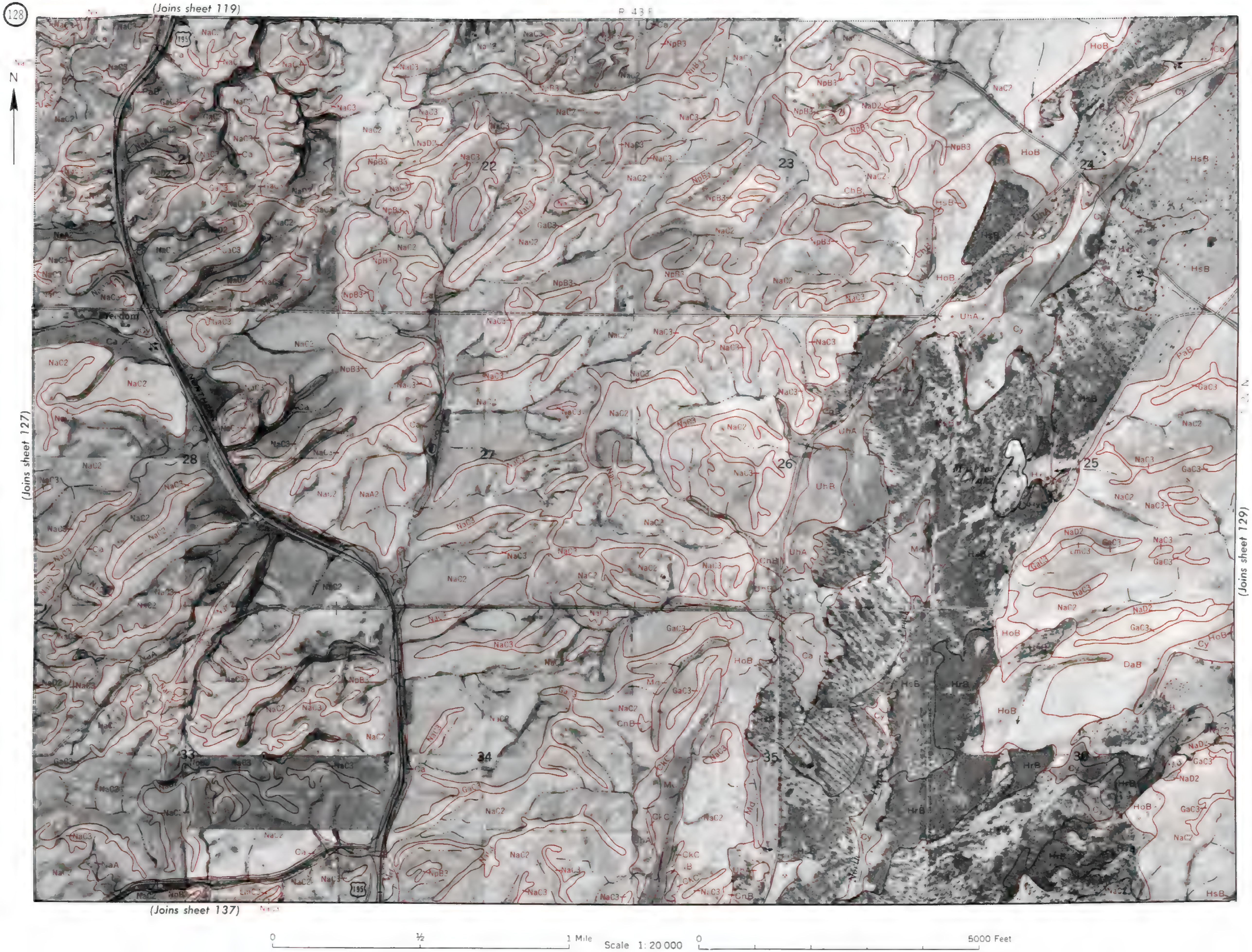
SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 127



Scale 1:20 000 — 0, ½, 1 Mile — 0, 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

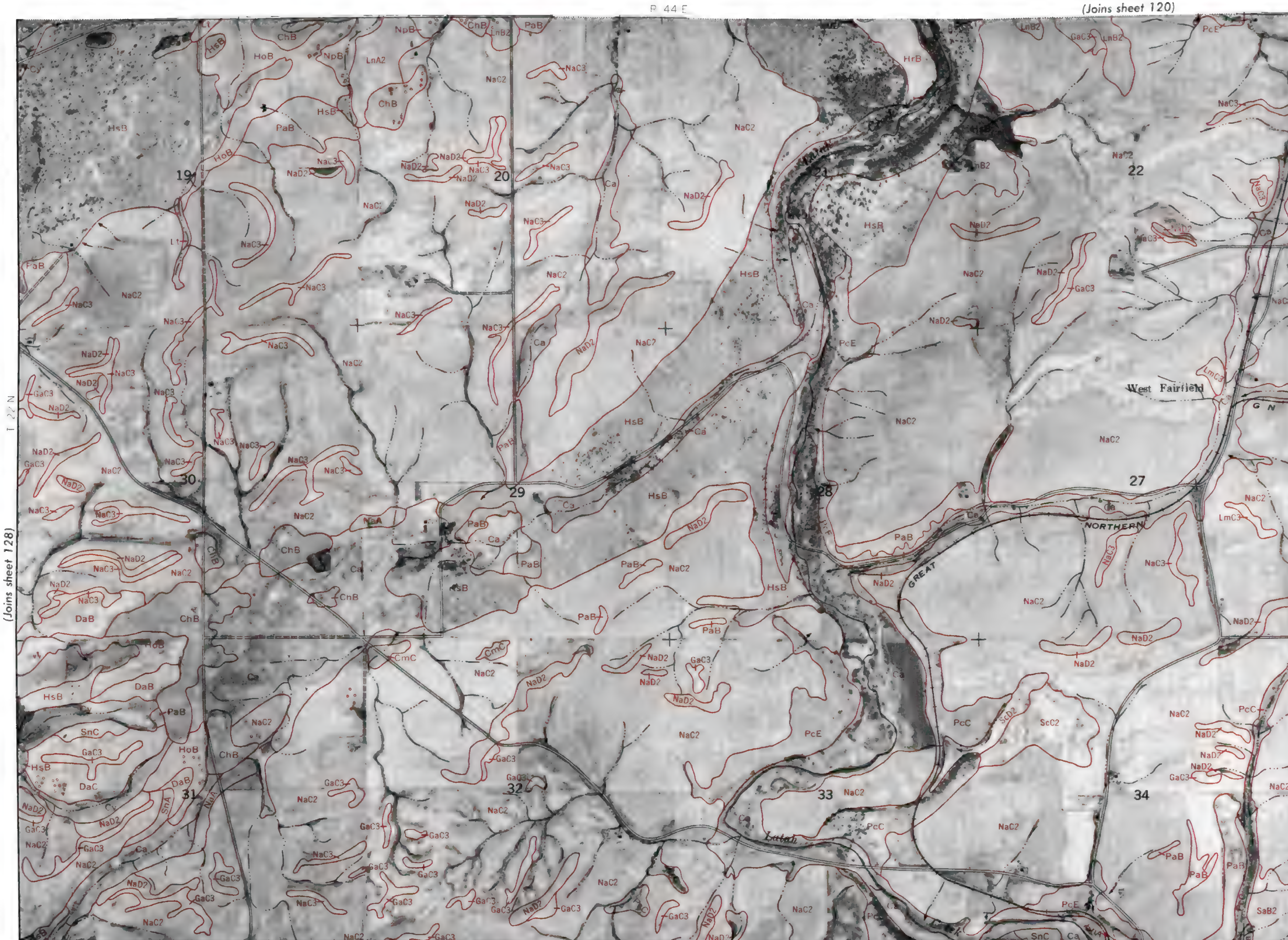
Range, township, and section corners shown on this map are indefinite.


128
(Joins sheet 119)
N
(Joins sheet 127)
(Joins sheet 129)
(Joins sheet 137)
21
22
23
24
25
26
27
28
33
34
35
36
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

R. 44 E.

(Joins sheet 120)

129



(Joins sheet 128)

(Joins sheet 130)

(Joins sheet 138)

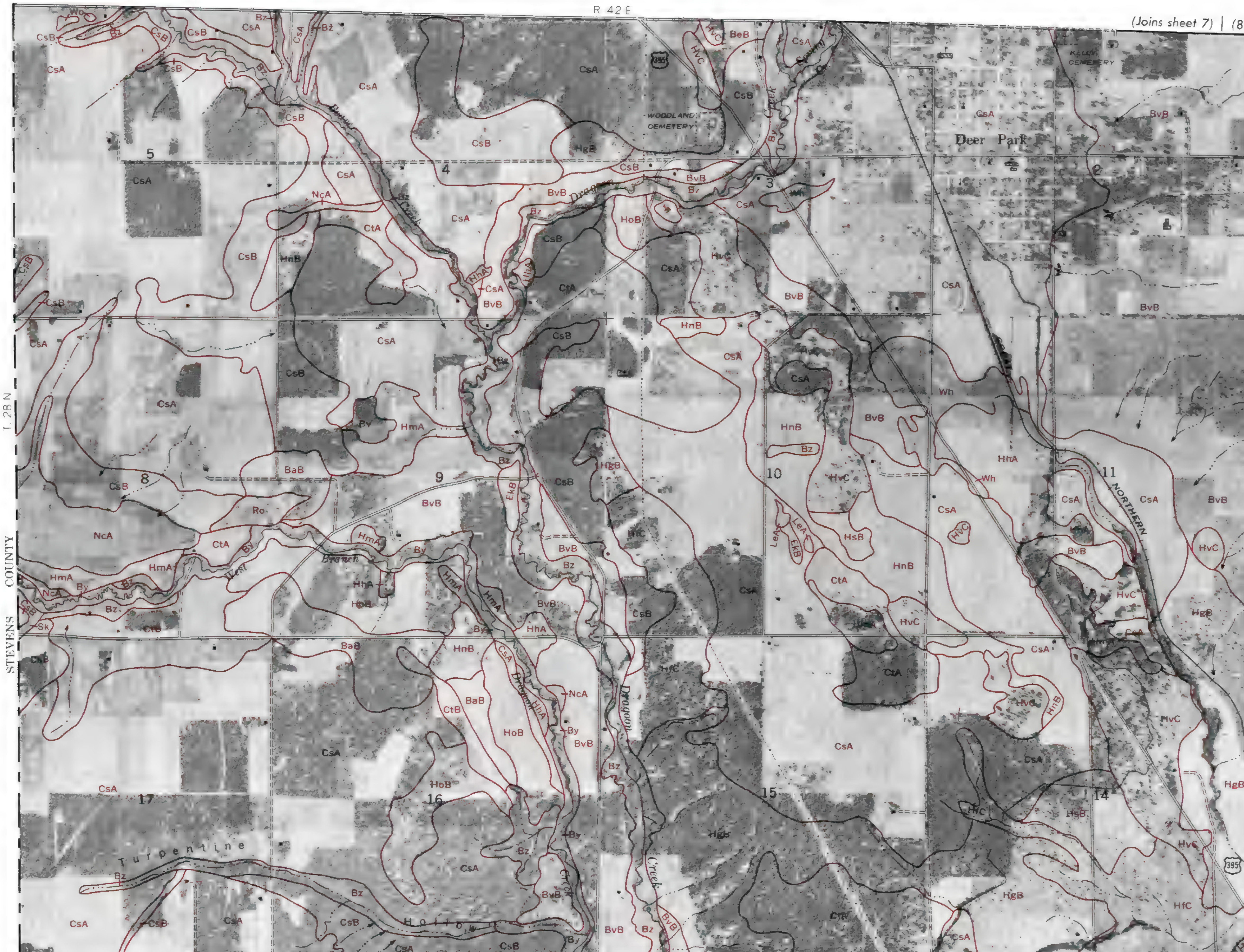
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

13

(Joins sheet 7) | (8)



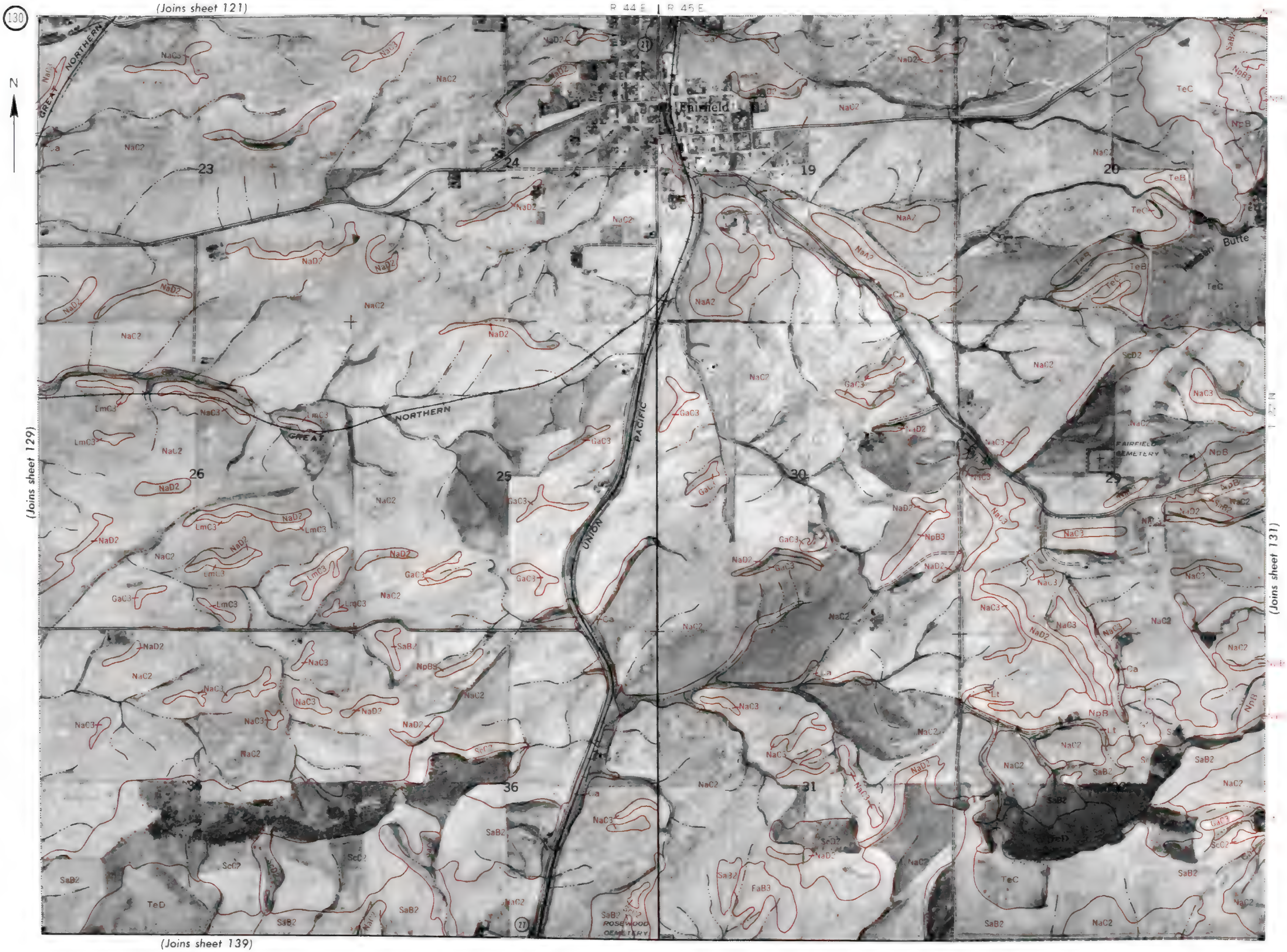
(Joins sheet 14)

(Joins sheet 20)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

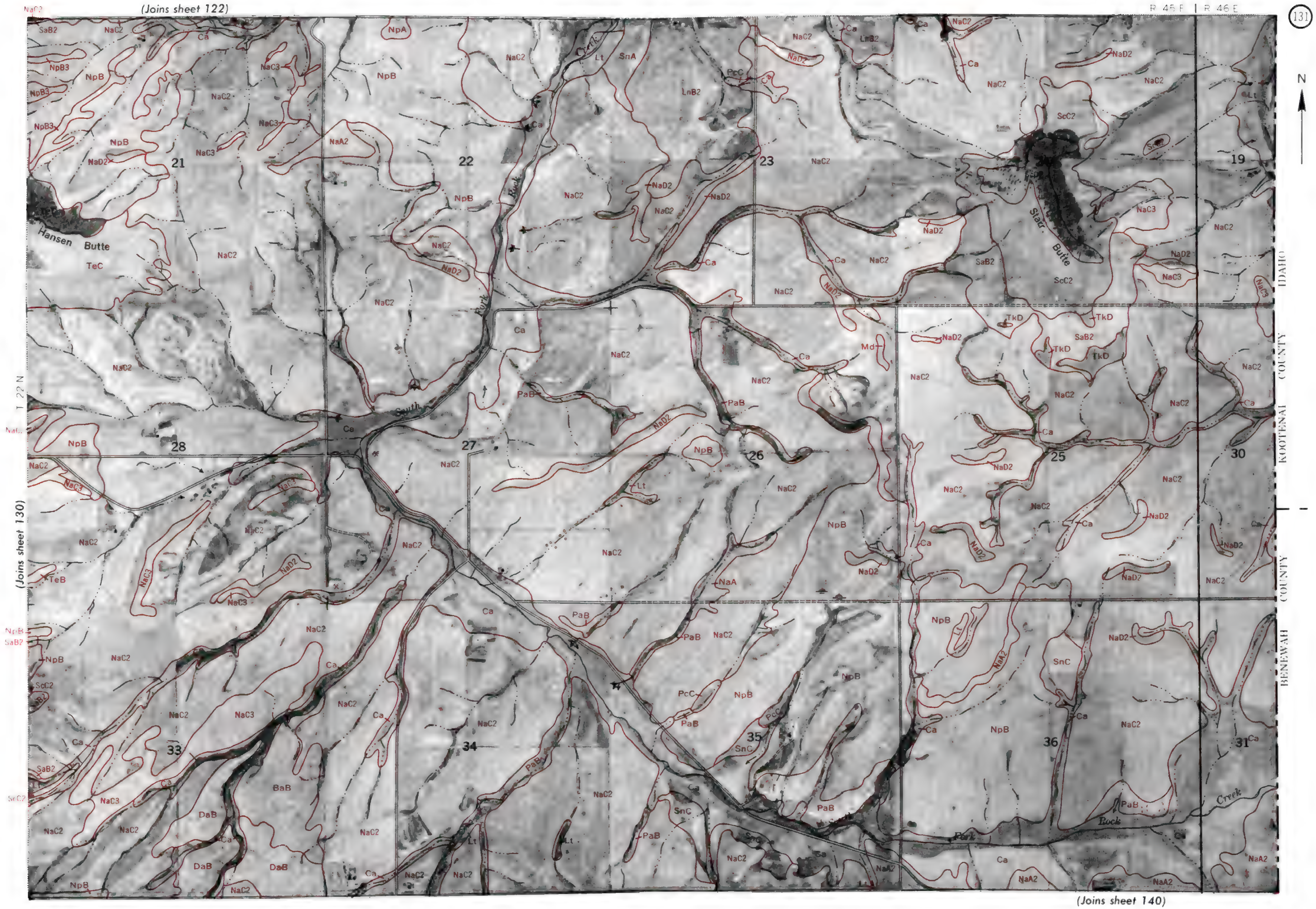
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 131

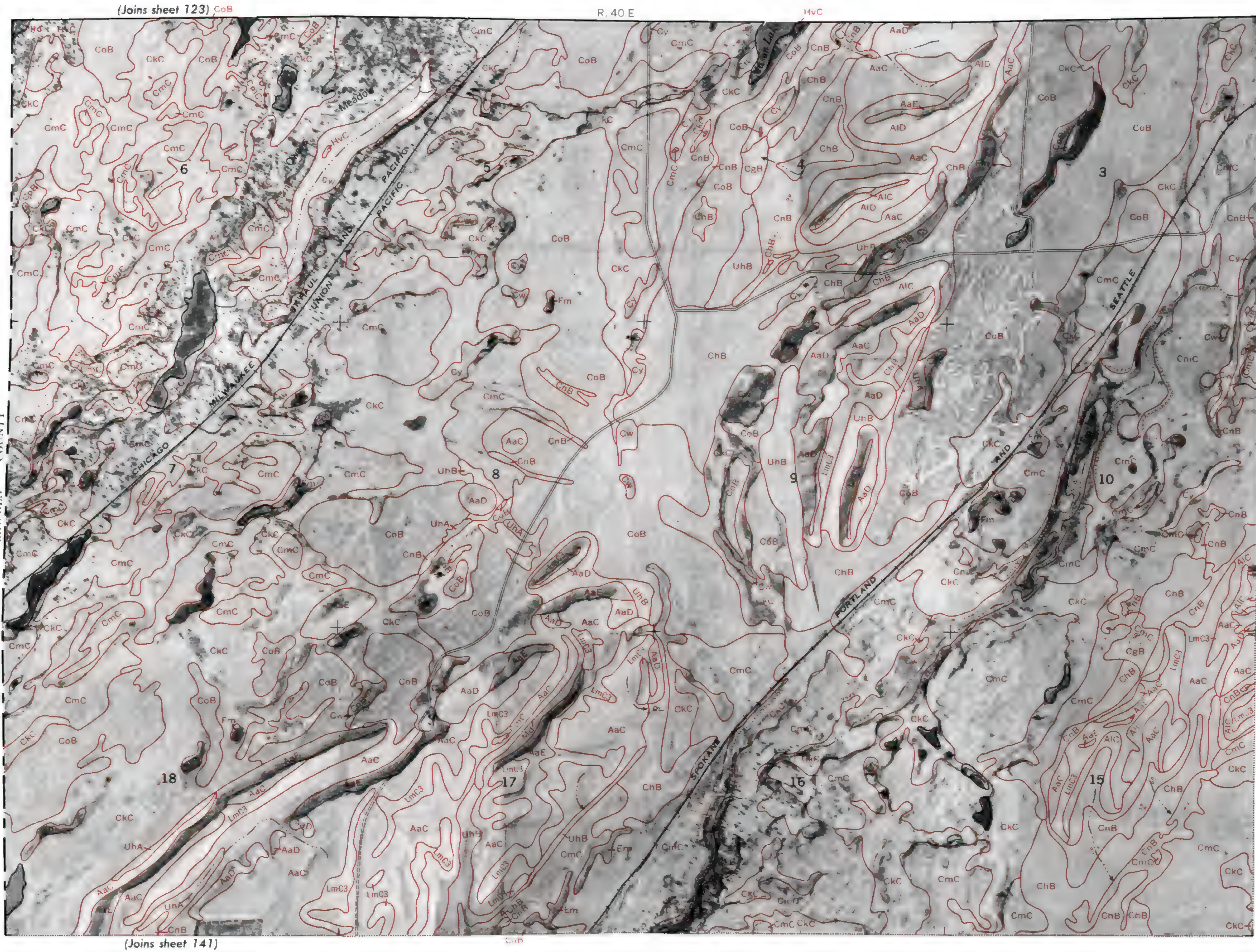


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 132



0 ½ 1 Mile

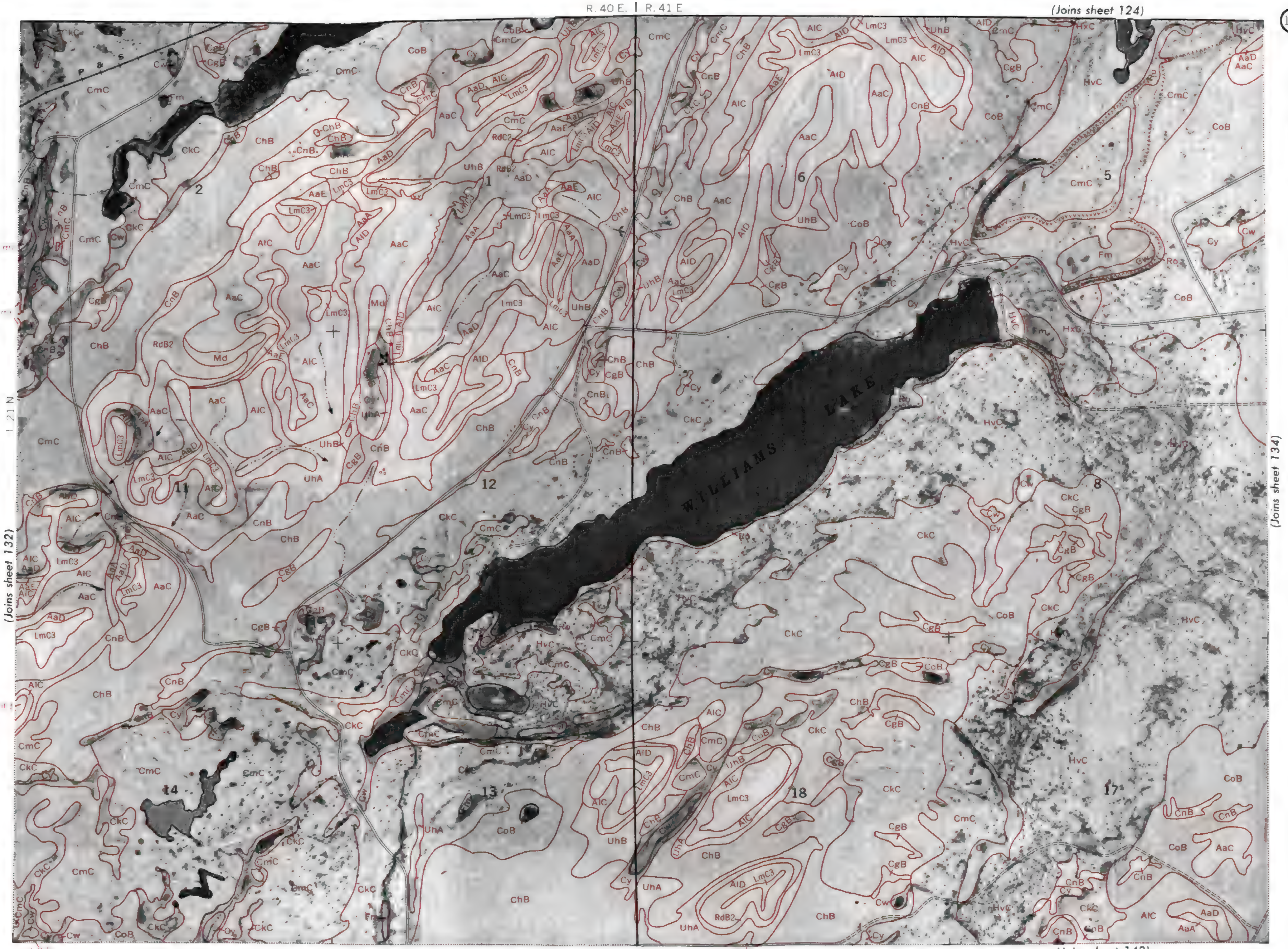
Scale 1: 20 000

0 5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 133

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite



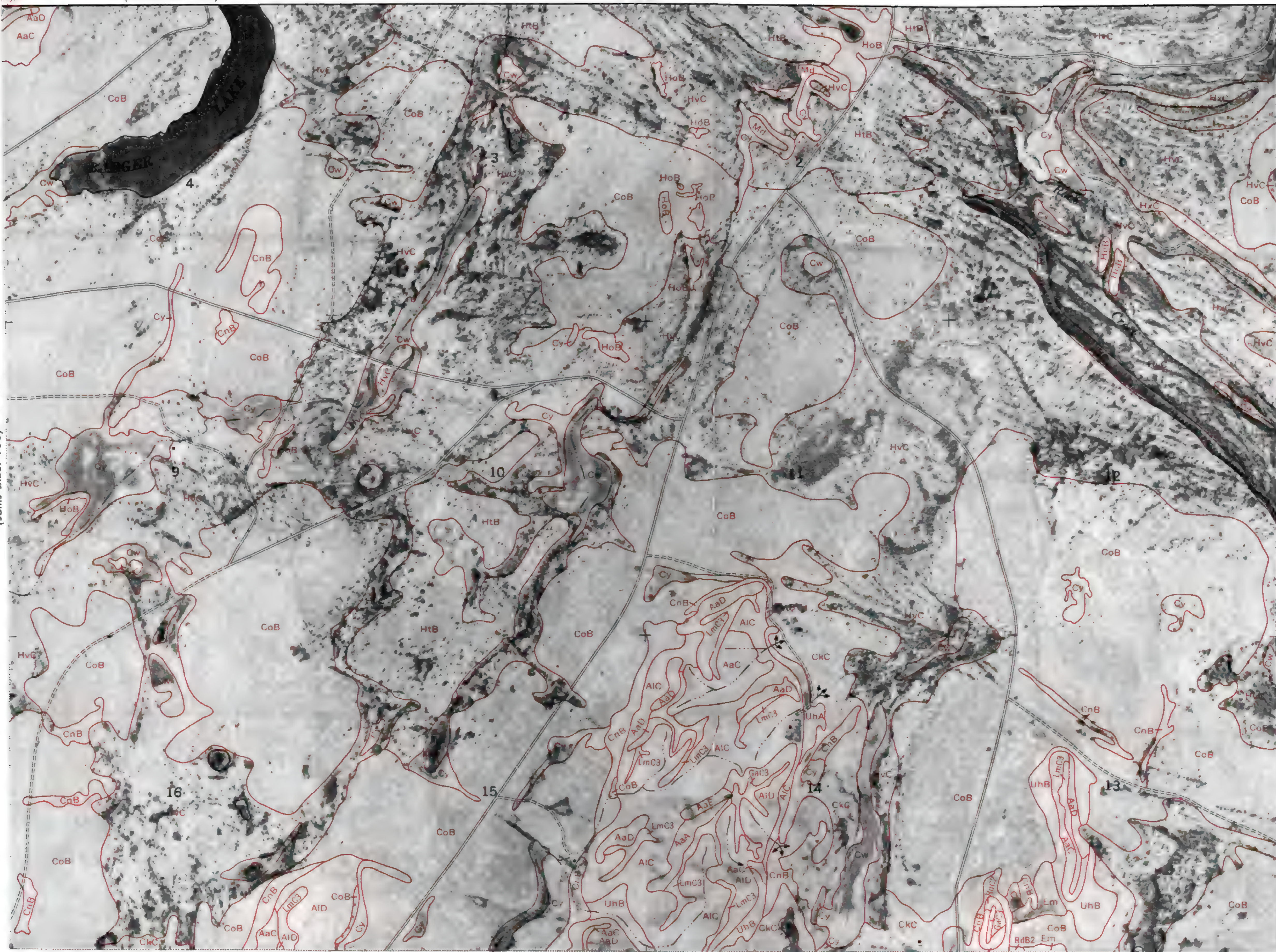
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

134

(Joins sheet 125)

R 41 E

N



(Joins sheet 133)

T. 21 N.

(Joins sheet 135)

(Joins sheet 143)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

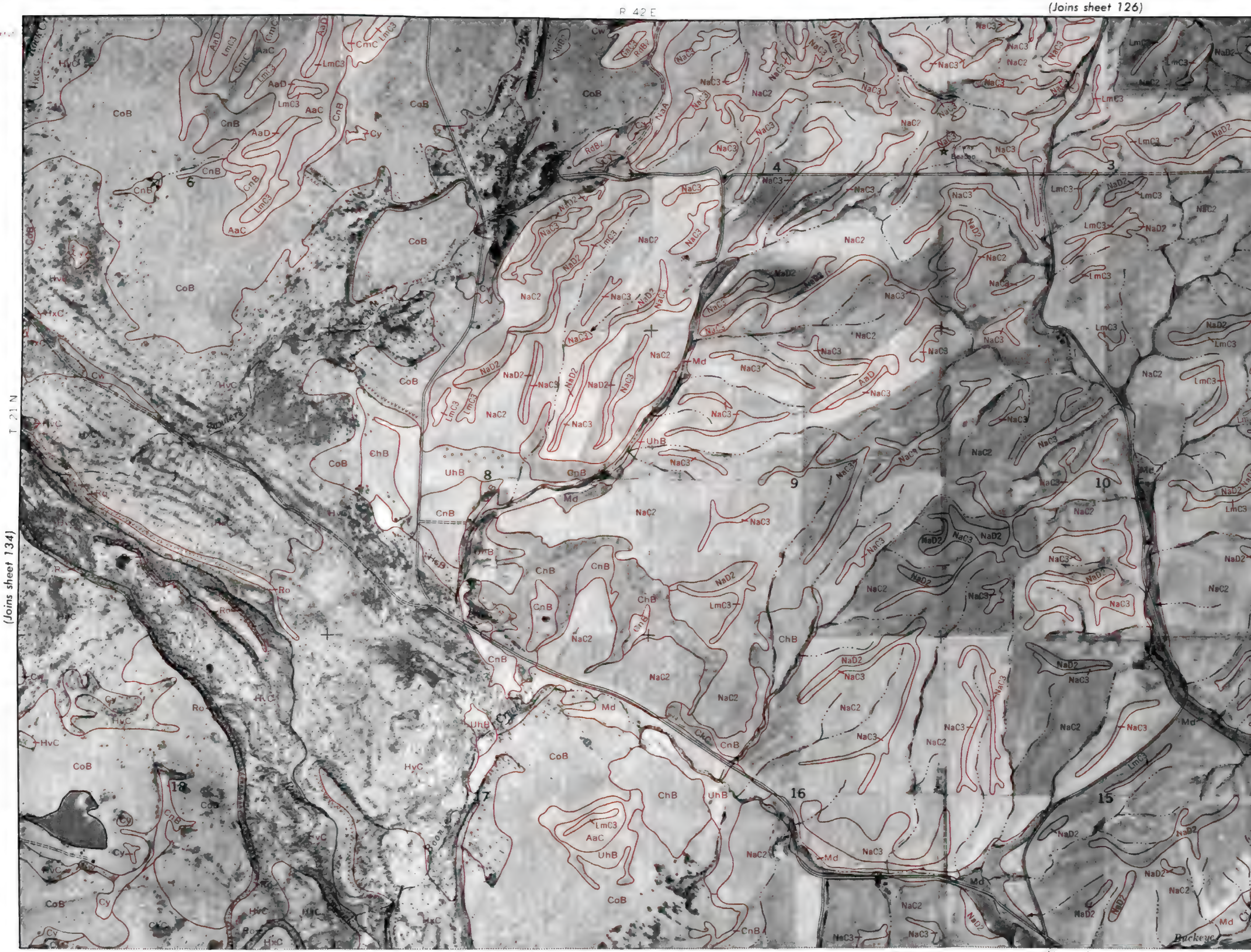
135

R 42 E

(Joins sheet 126)

(Joins sheet 134)

T 21 N



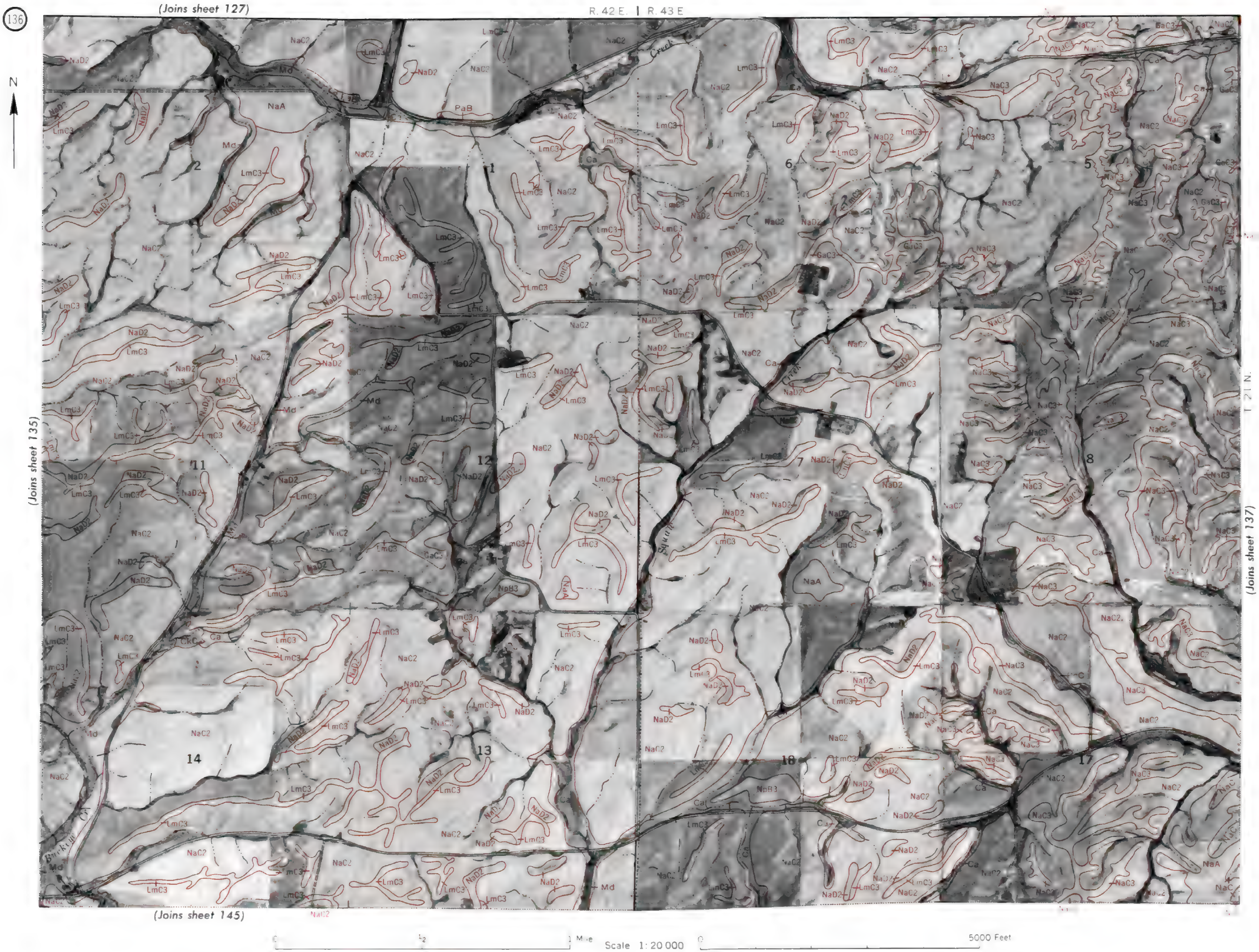
(Joins sheet 136)

(Joins sheet 144)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

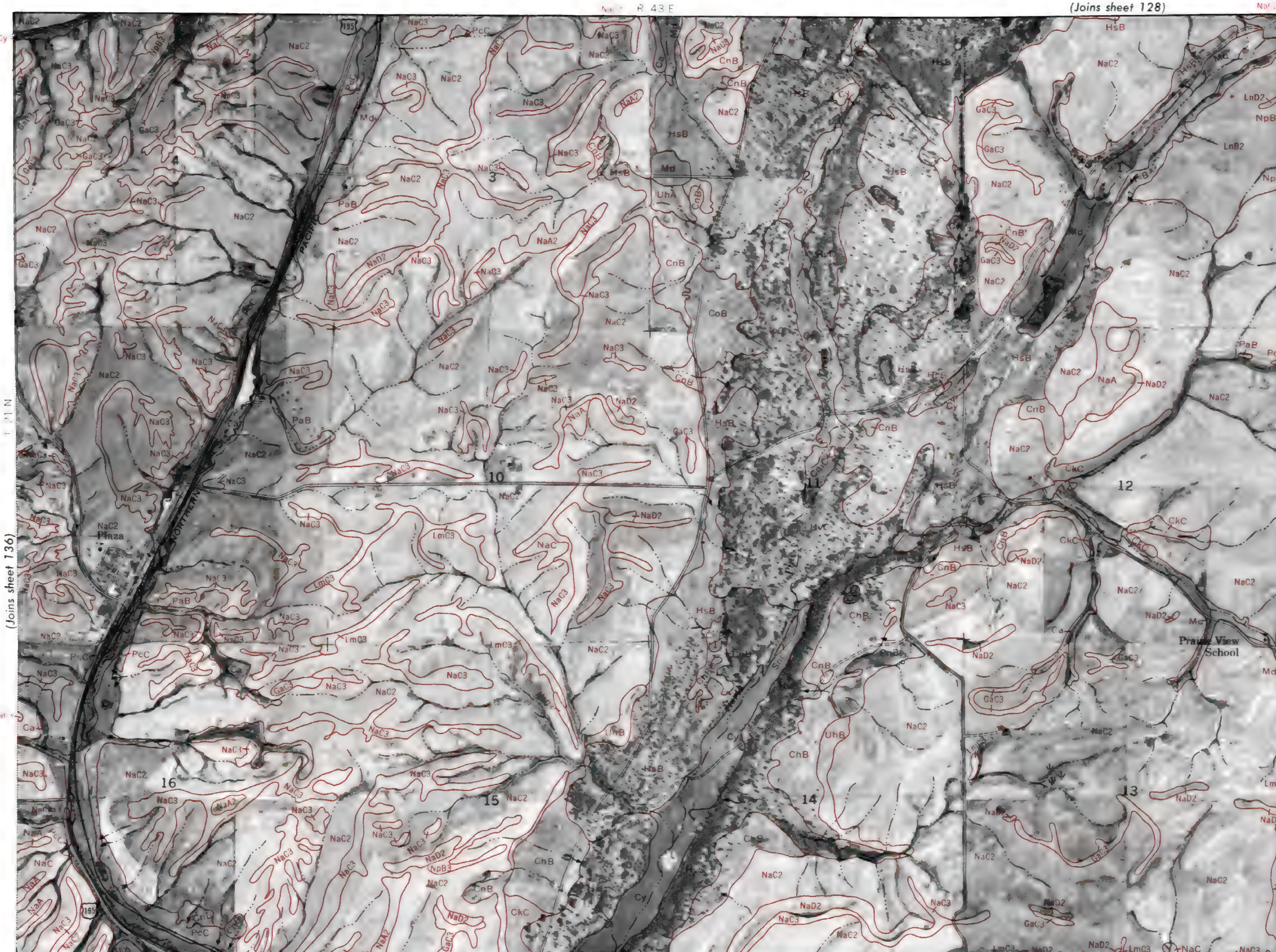
Range, township, and section corners shown on this map are indefinite


136
(Joins sheet 127)
R. 42 E. | R. 43 E.
N
(Joins sheet 135)
(Joins sheet 137)
T. 21 N.
(Joins sheet 145)
Creek
Squaw
Buckeye Cr.
1
2
5
6
7
8
11
12
13
14
17
18
NaA
NaC2
NaD2
NaC3
LmC3
Md
Ca
CkC
GaC3
NaB3
PaB
0
½
1 Mile
Scale 1:20 000
0
5000 Feet

(Joins sheet 128)

(Joins sheet 136)

(Joins sheet 138)



(Joins sheet 146)

Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

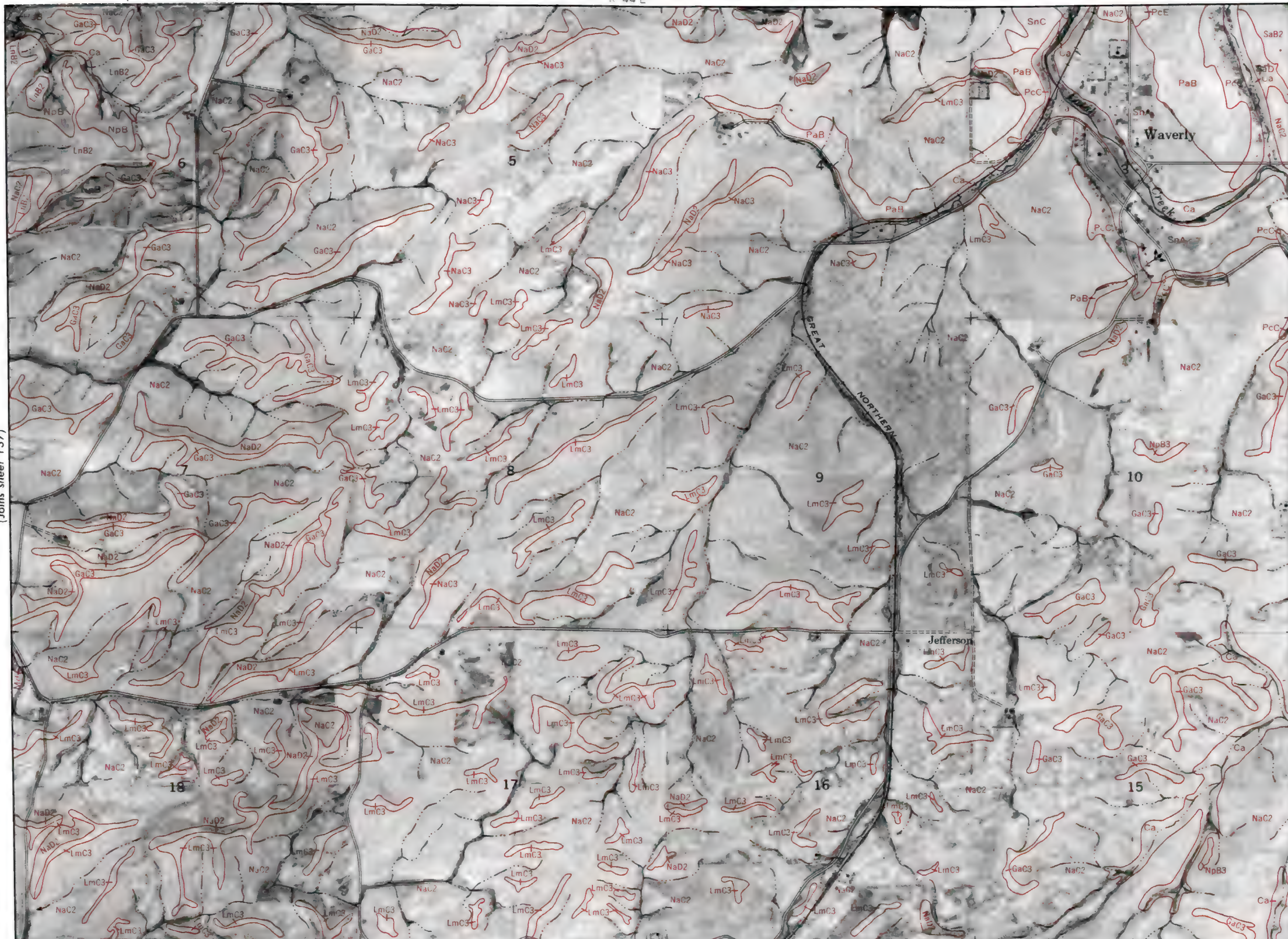
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

138

(Joins sheet 129)

R 44 E

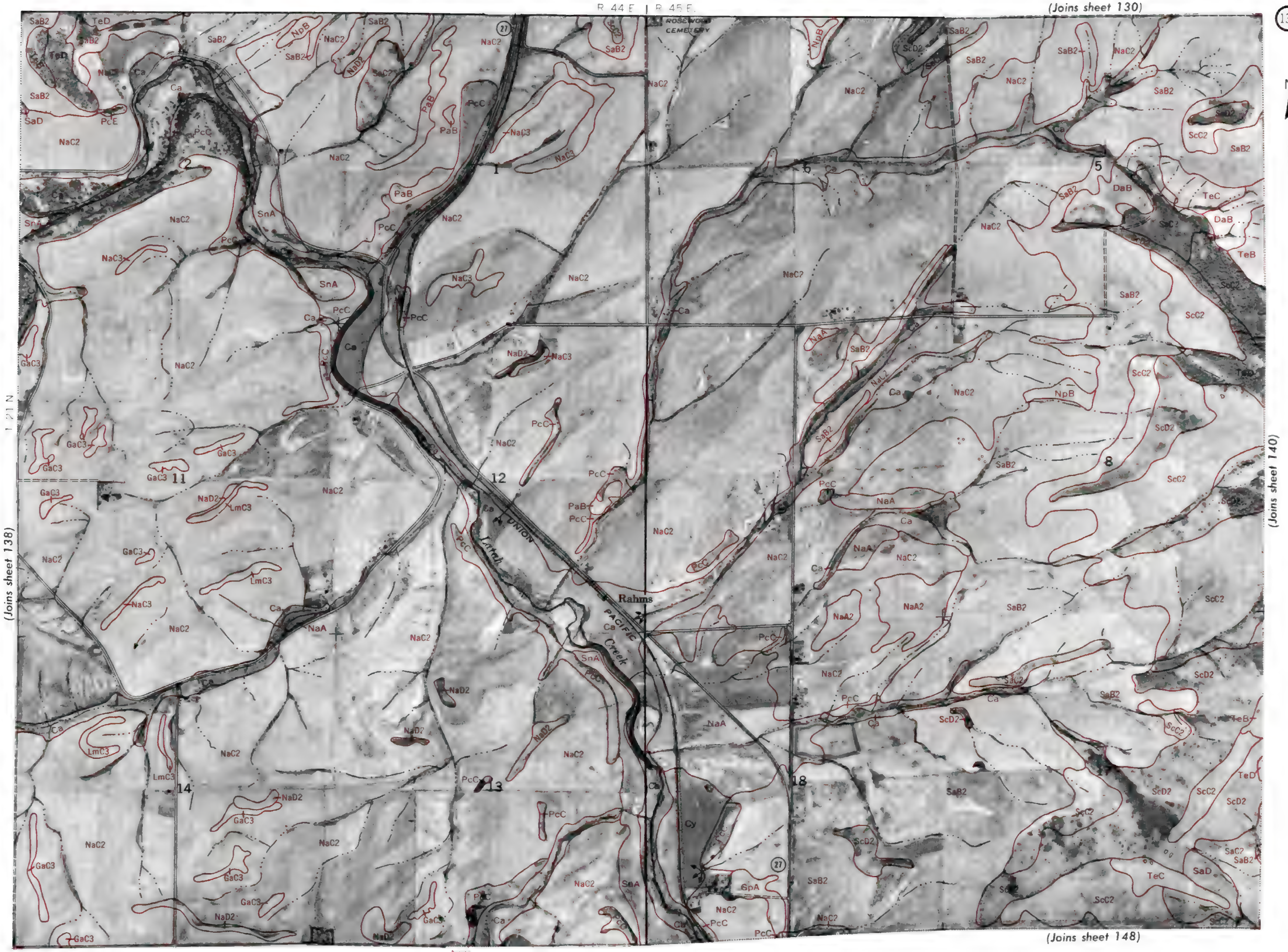


(Joins sheet 137)

(Joins sheet 139)

(Joins sheet 147)

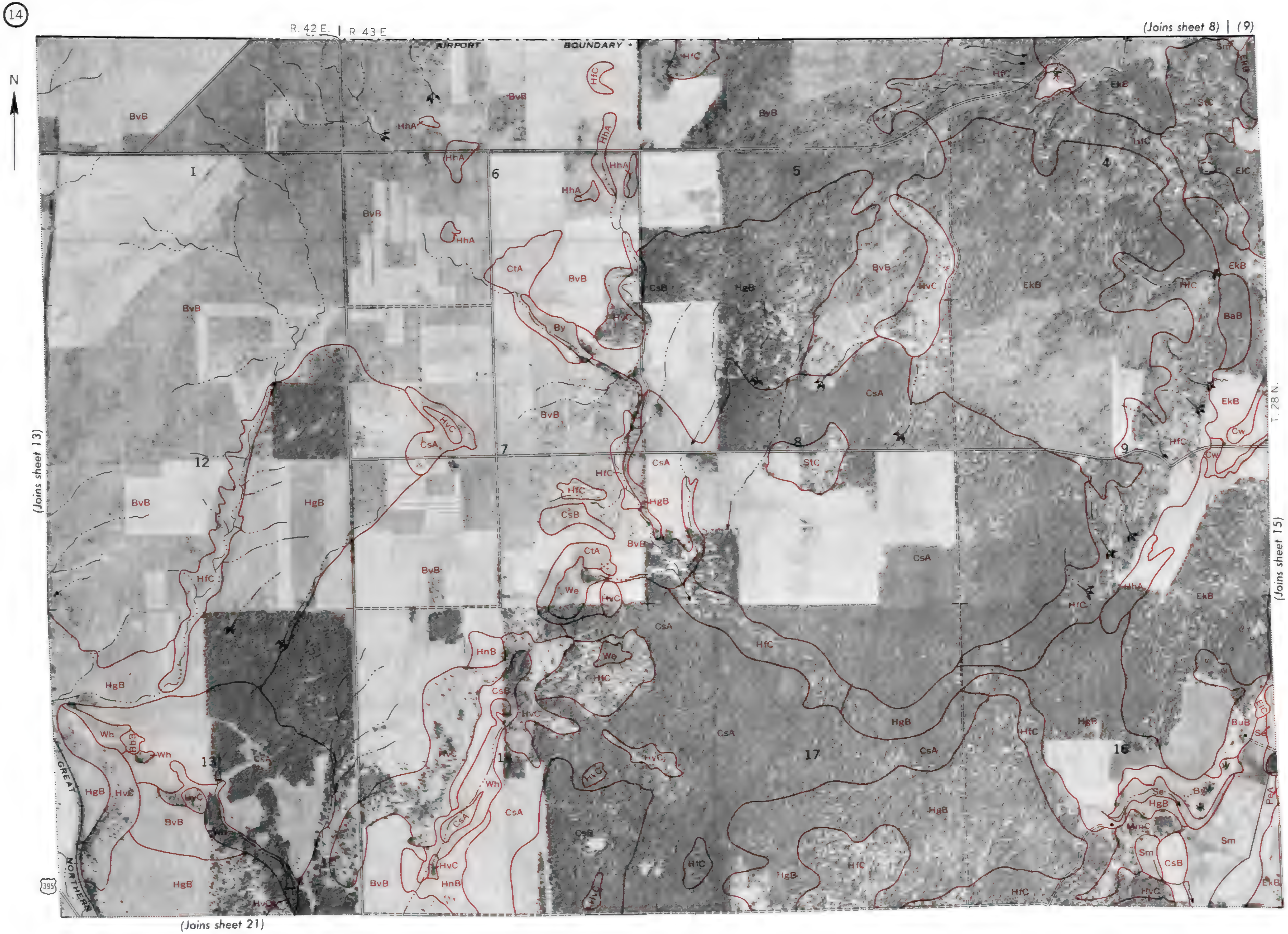
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 140

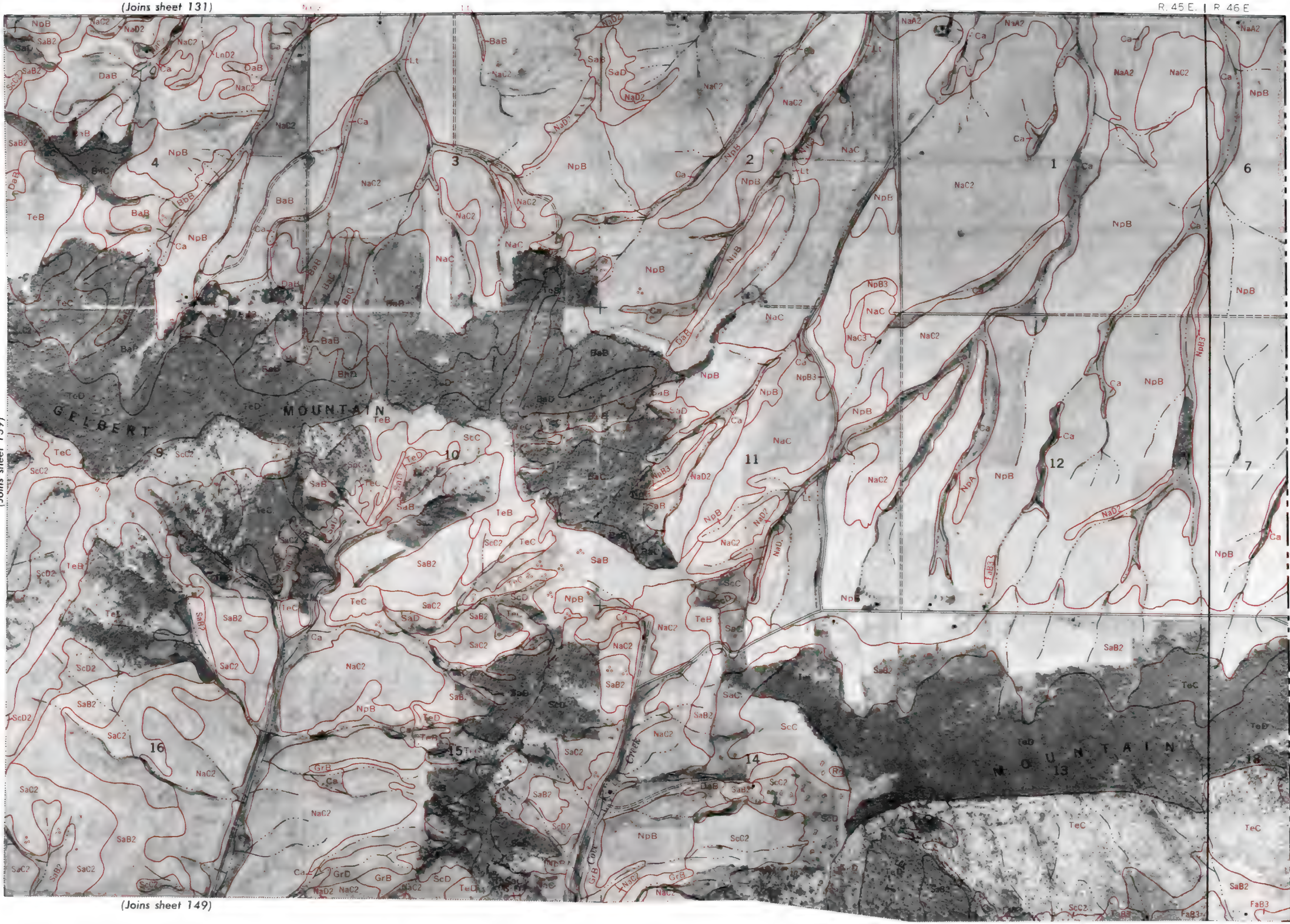
140

(Joins sheet 131)

R. 45 E. | R. 46 E.

N

(Joins sheet 139)



T. 21 N.

IDAHO

BENEWAH COUNTY

(Joins sheet 149)

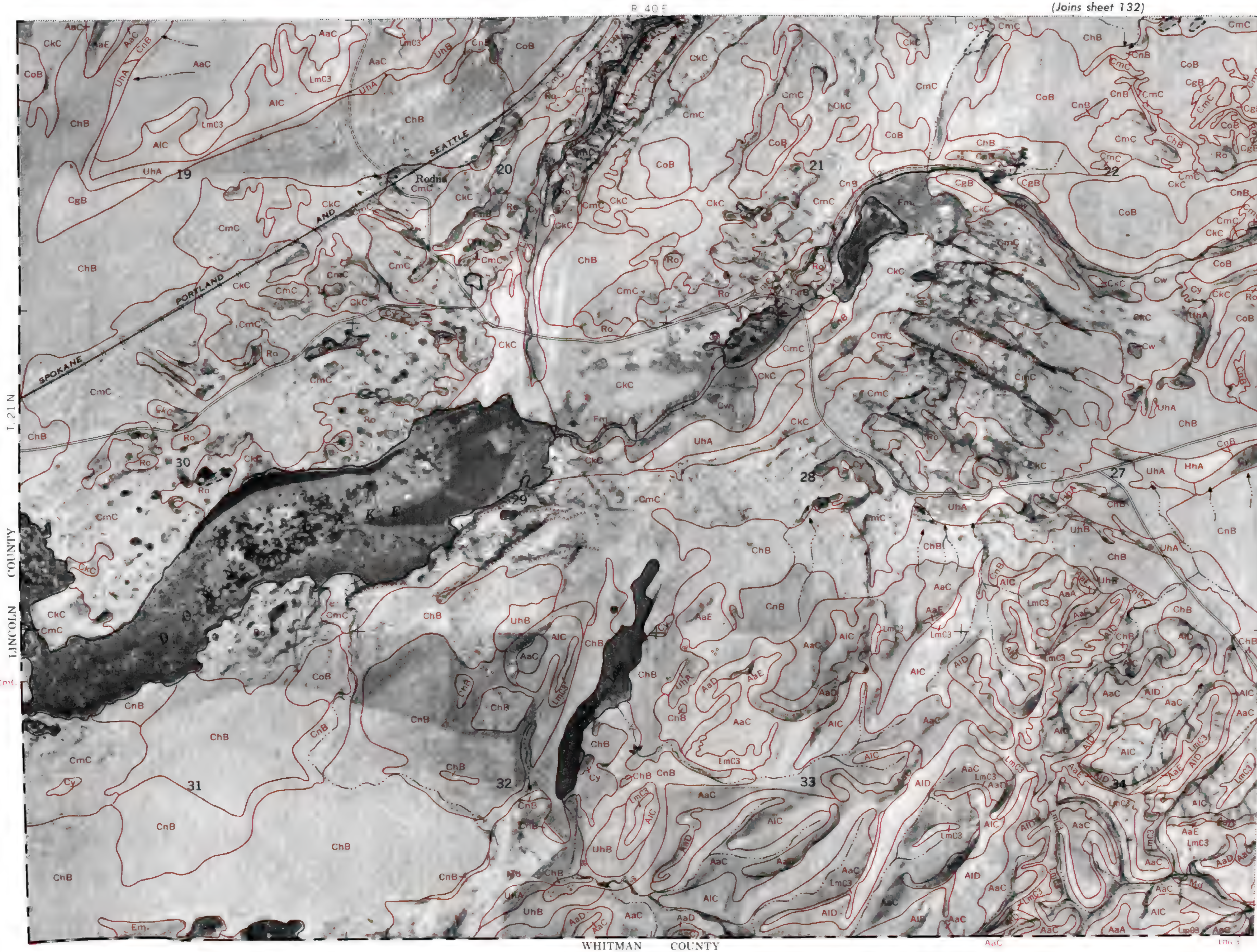
0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 132)

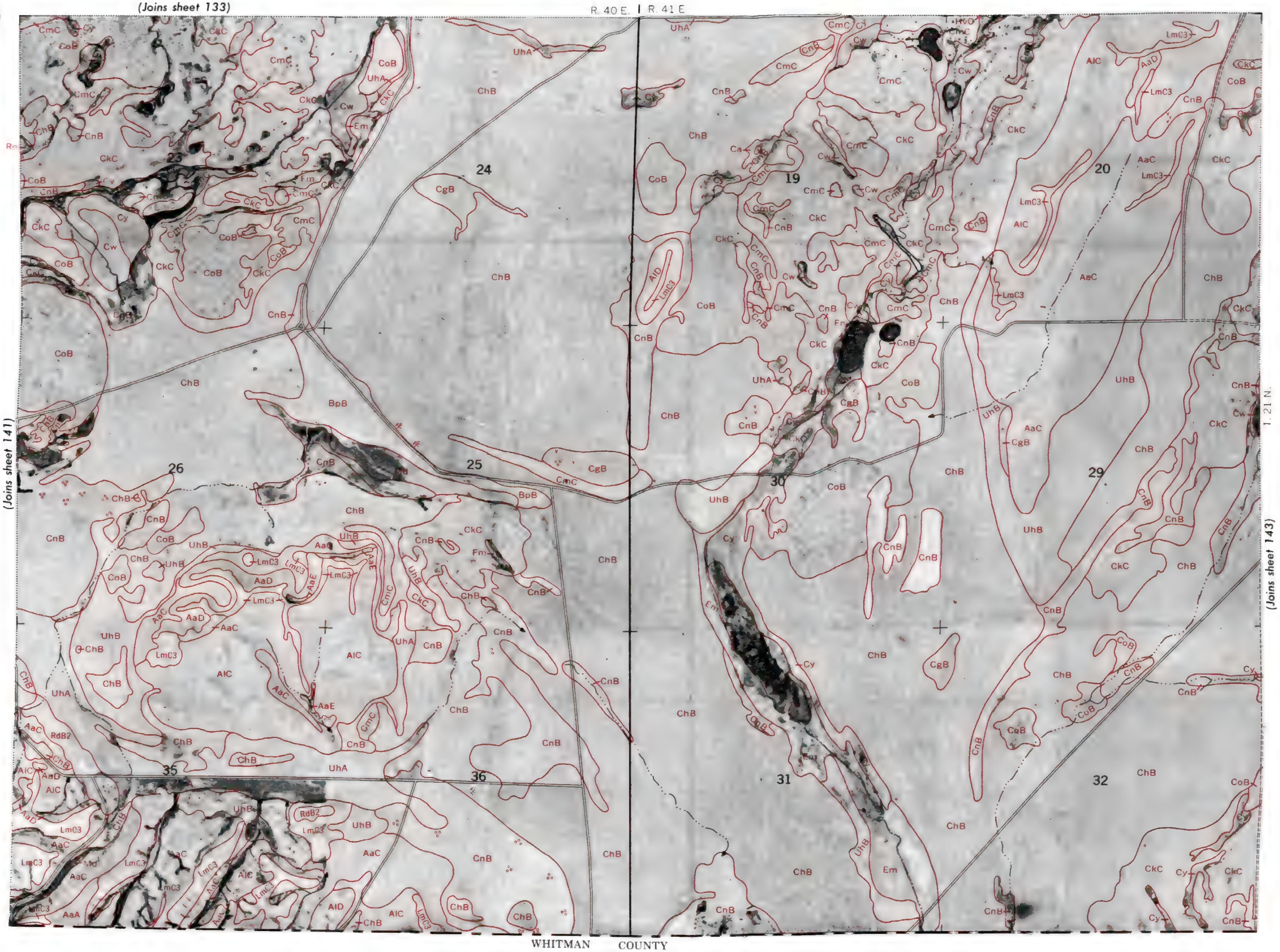
141



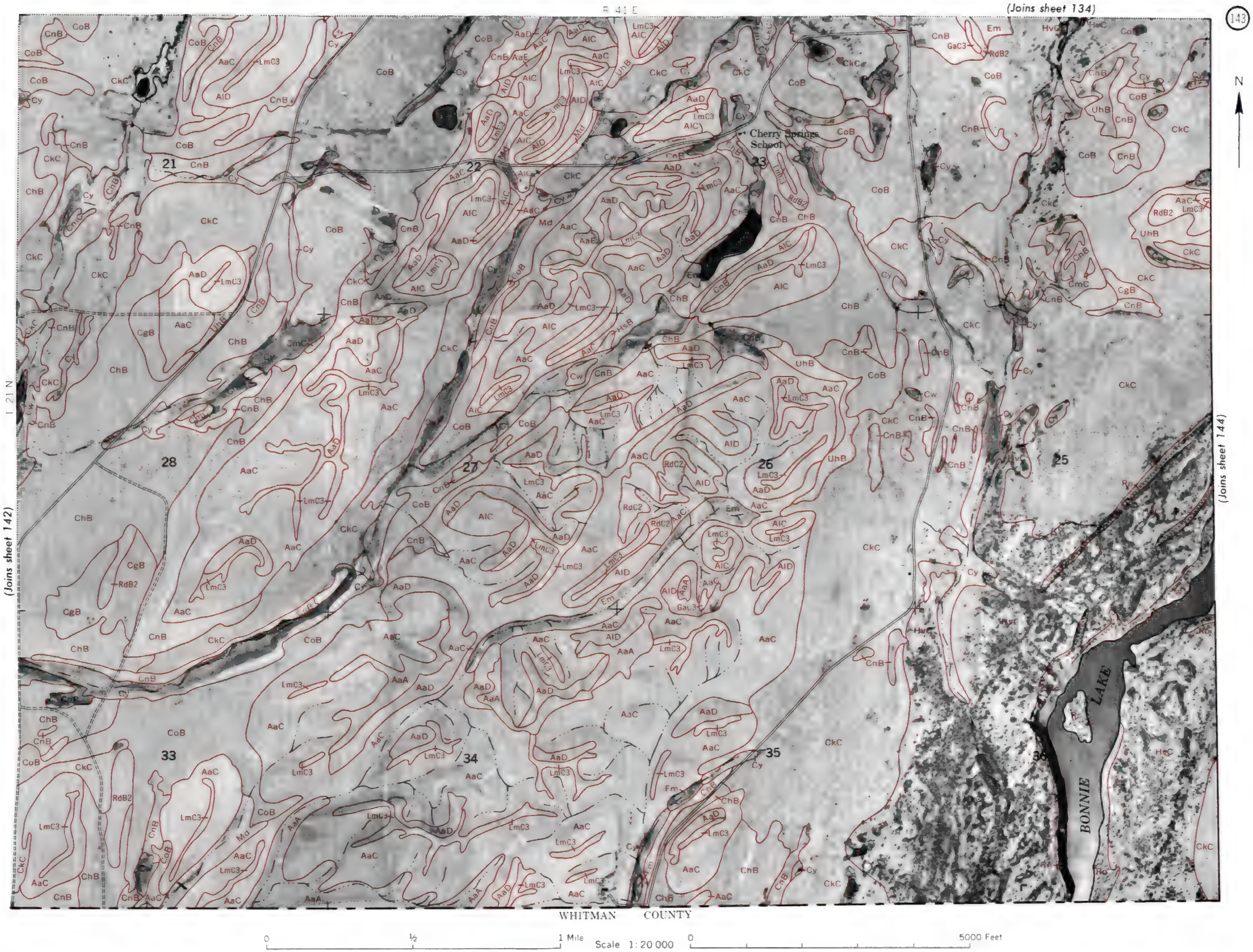
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

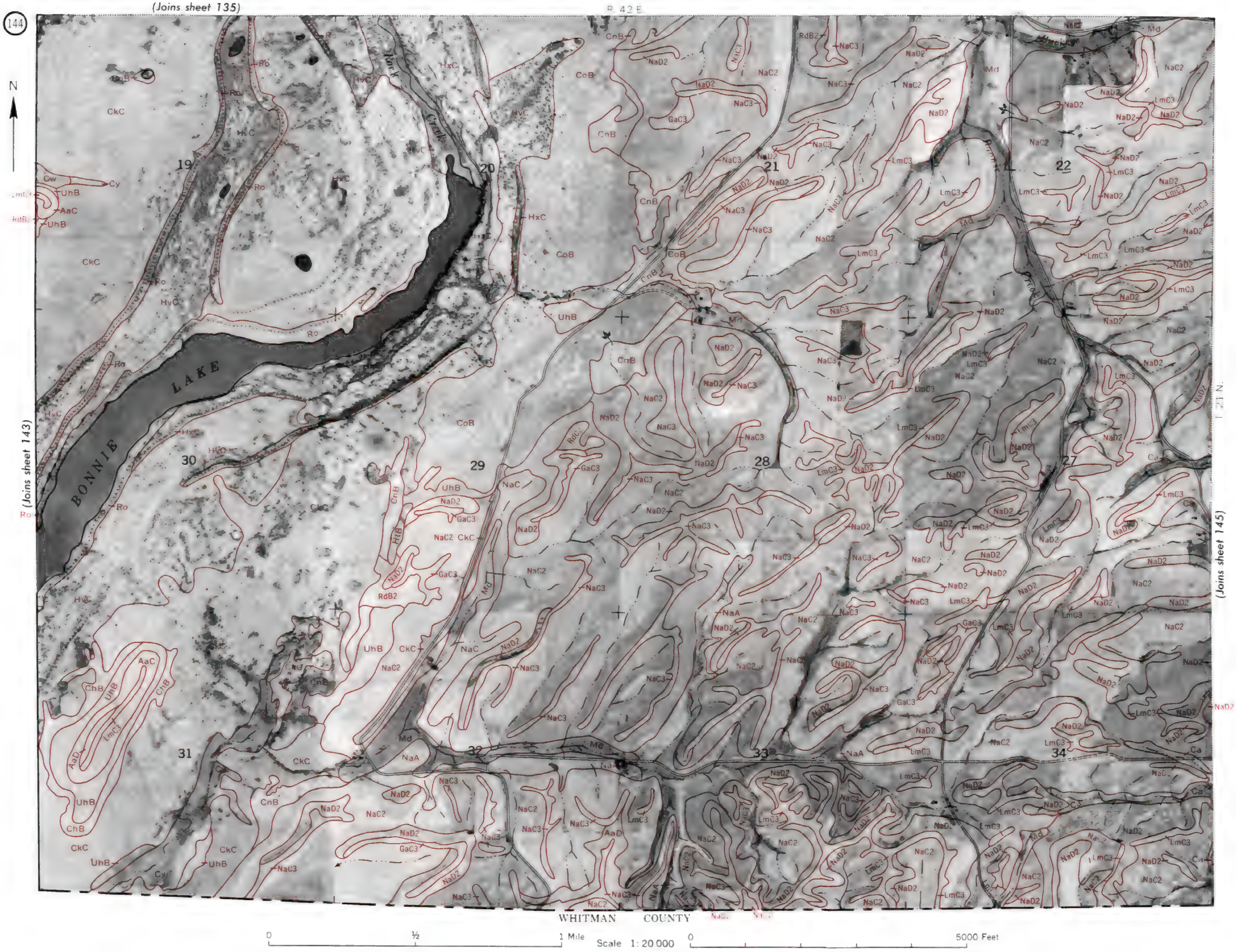


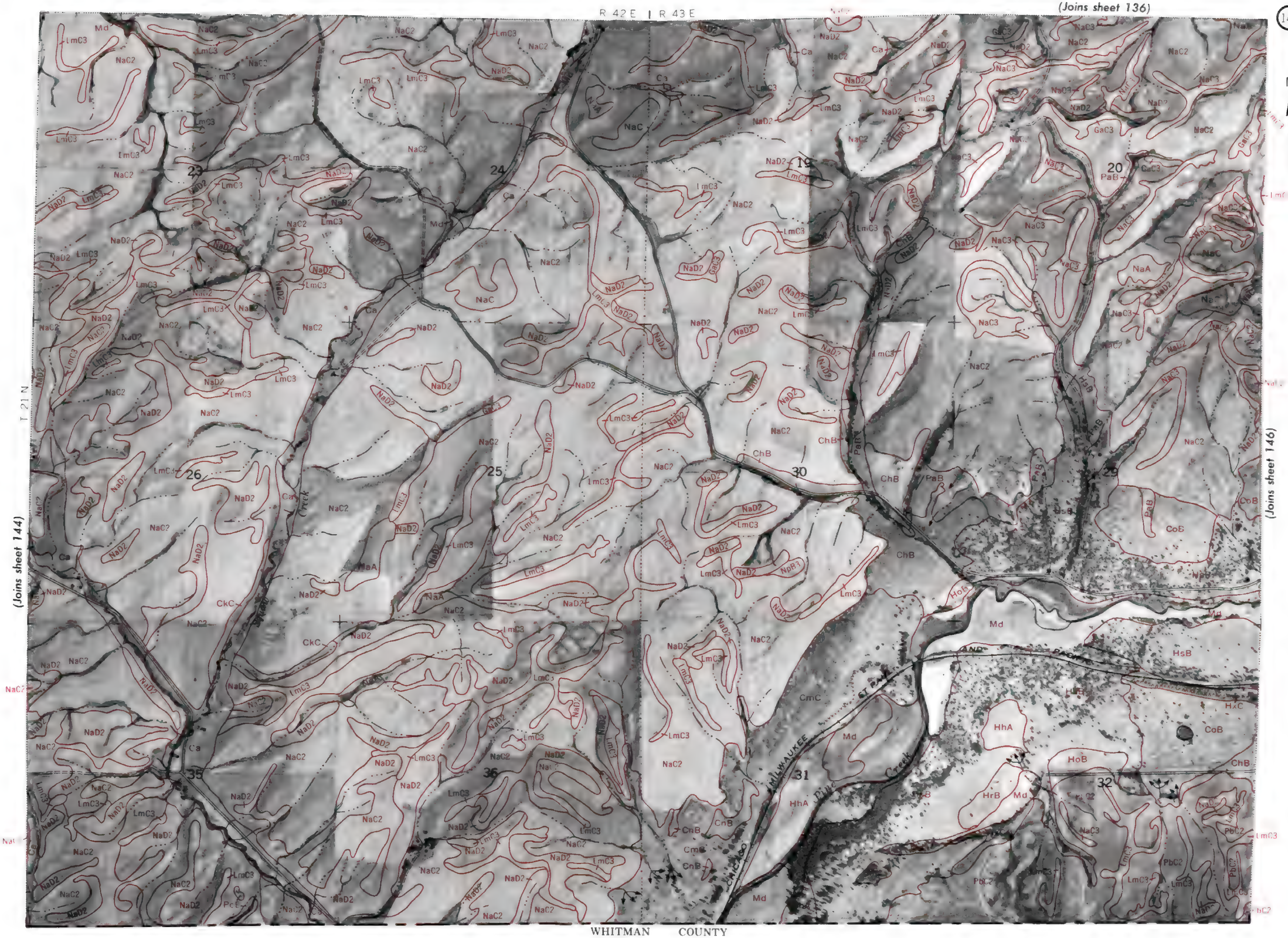
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

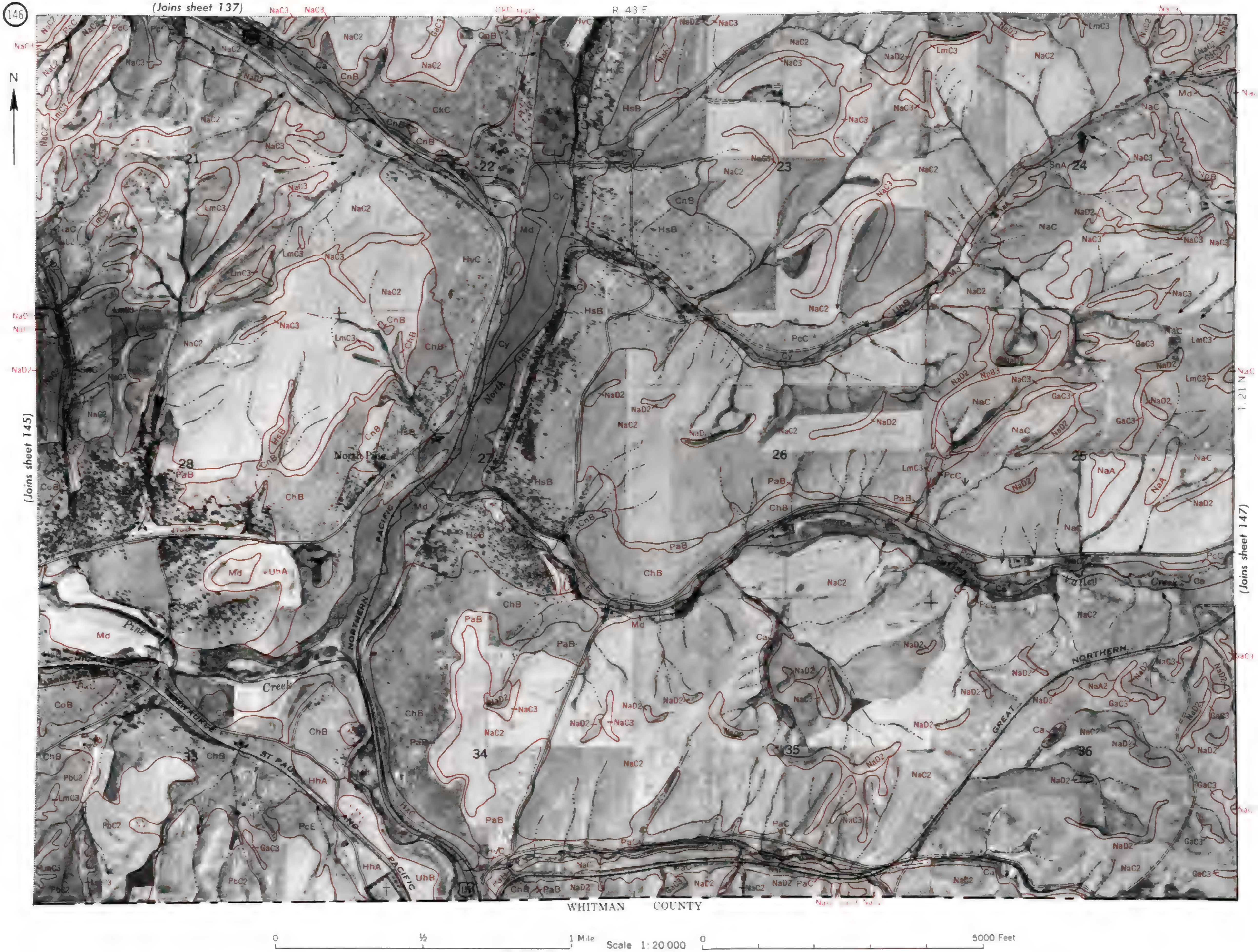

144
(Joins sheet 135)
R. 42 E.
(Joins sheet 143)
(Joins sheet 145)
T. 21 N.
N
BONNIE LAKE
Rock Creek
19
20
21
22
27
28
29
30
31
32
33
34
WHITMAN COUNTY
0
½
1 Mile
Scale 1:20 000
0
5000 Feet
CkC
CoB
CnB
UhB
HxC
HyC
Ro
Cy
Cw
AaC
AaD
ChB
LmC3
NaC2
NaC3
NaD2
NaA
NaC
GaC3
Md
RdB2
RdC2
HtB
Ca



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite.

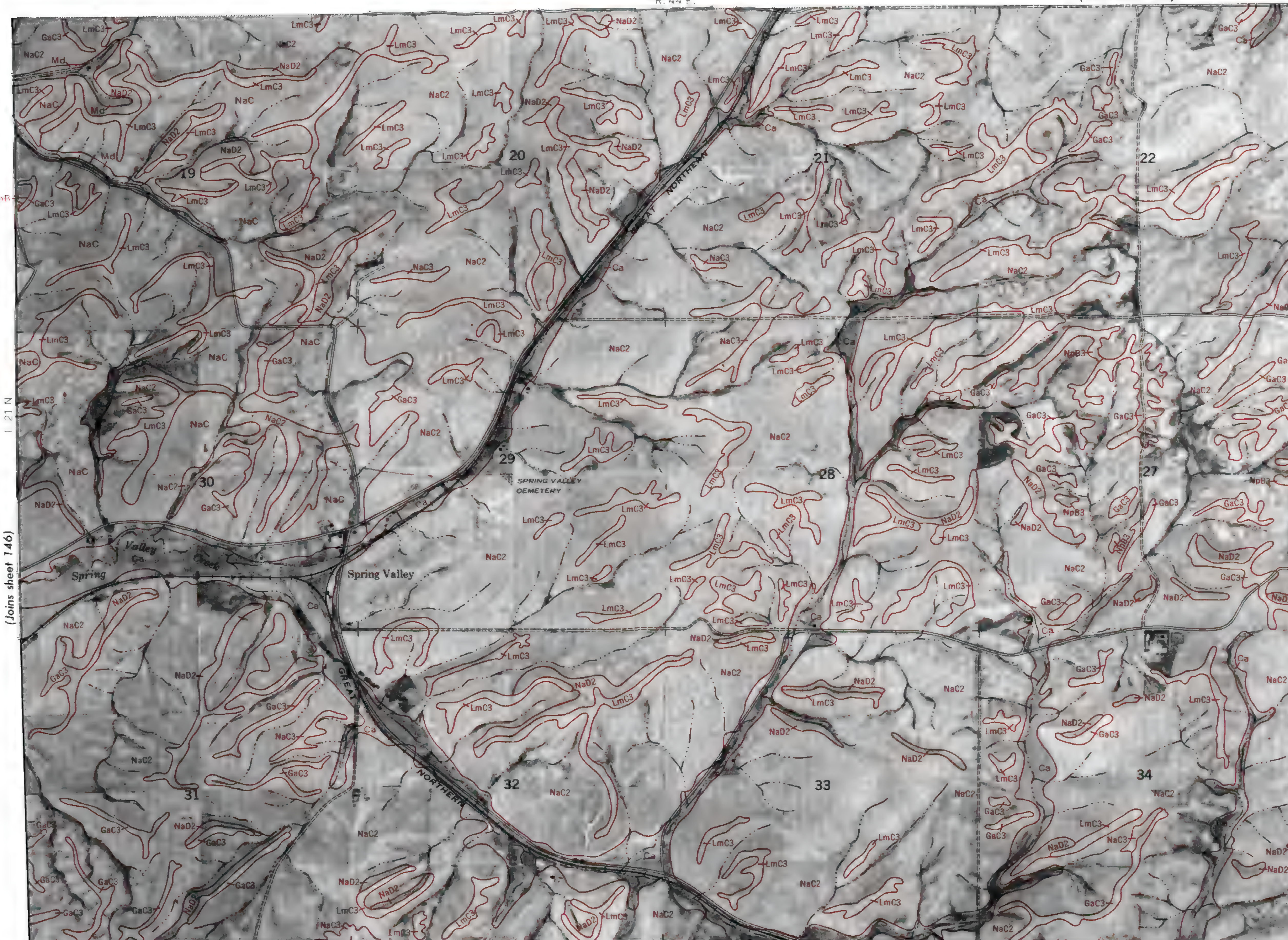
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet


146
(Joins sheet 137)
R 43 E
N
(Joins sheet 145)
(Joins sheet 147)
T 21 N
21
22
23
24
28
27
26
25
33
34
35
36
North Pine
Pine Creek
Valley Creek
NORTHERN PACIFIC
GREAT NORTHERN
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
WHITMAN COUNTY
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

R. 44 E.

(Joins sheet 138)

147



(Joins sheet 146)

(Joins sheet 148)

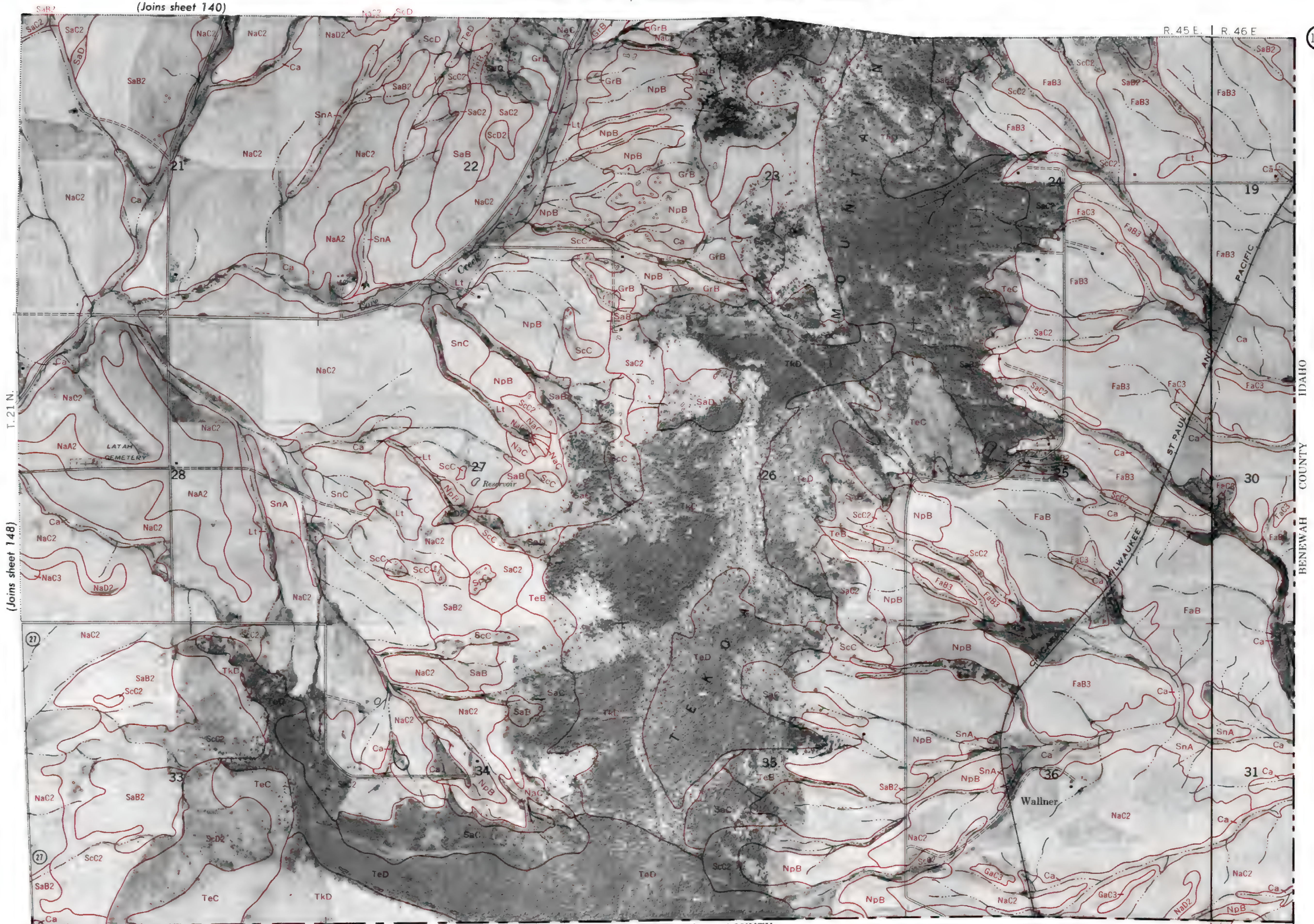
WHITMAN COUNTY

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite

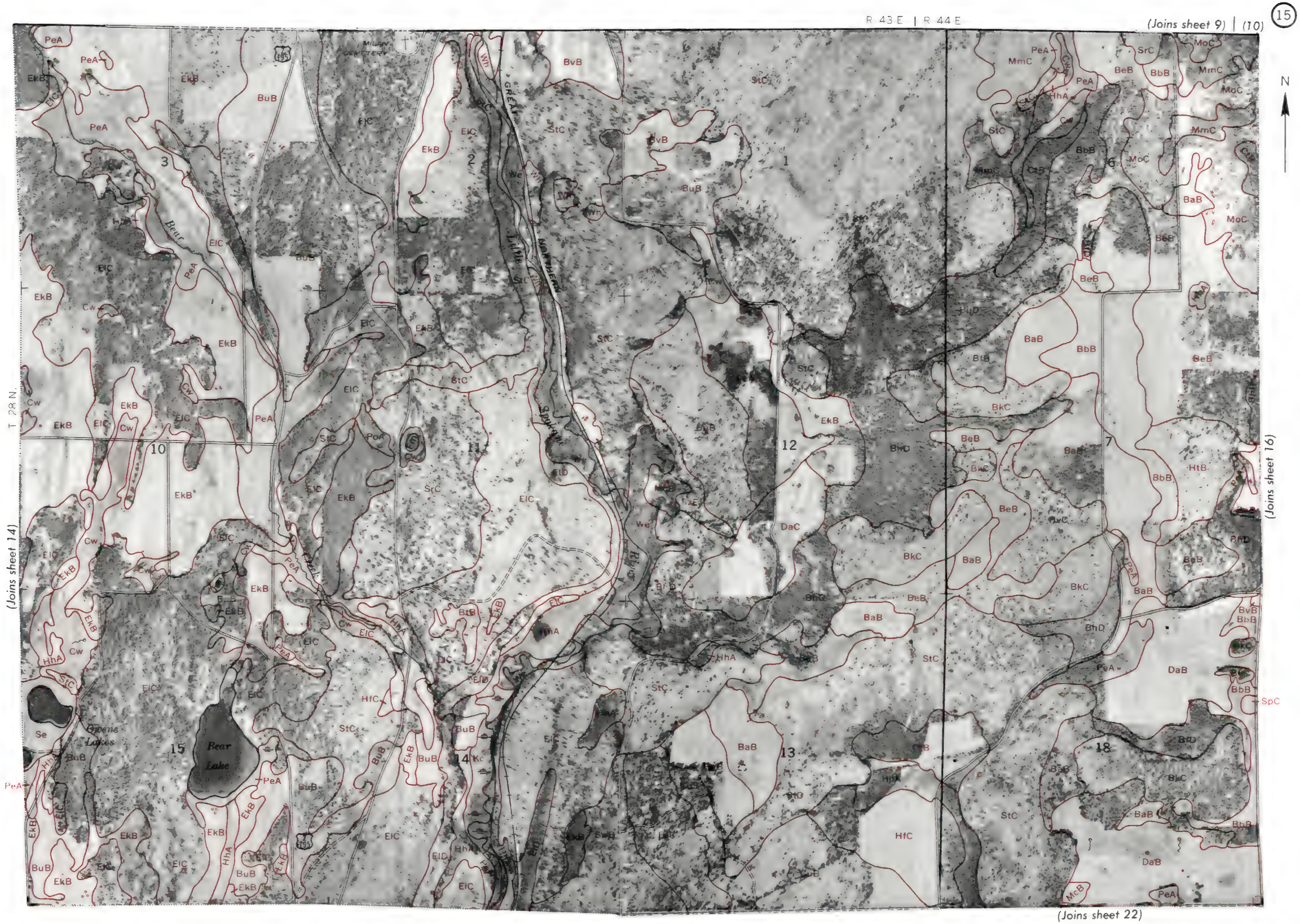

148
(Joins sheet 139)
R 44 E
R 45 E
N
(Joins sheet 147)
(Joins sheet 149)
T. 21 N.
FARMINGTON CEMETERY
UNION PACIFIC
23
24
19
20
26
25
30
29
35
36
31
32
WHITMAN COUNTY
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

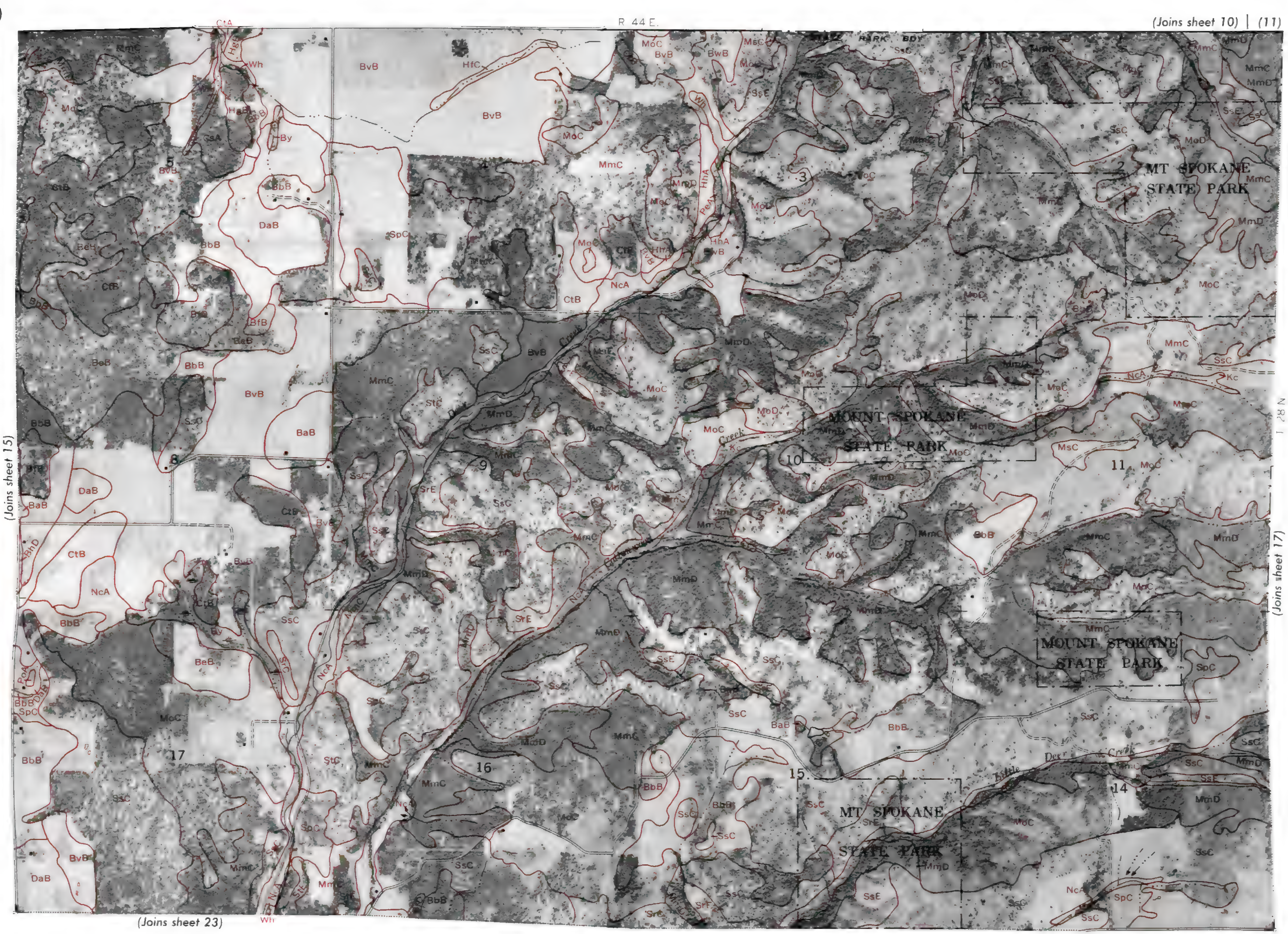
Range, township, and section corners shown on this map are indefinite



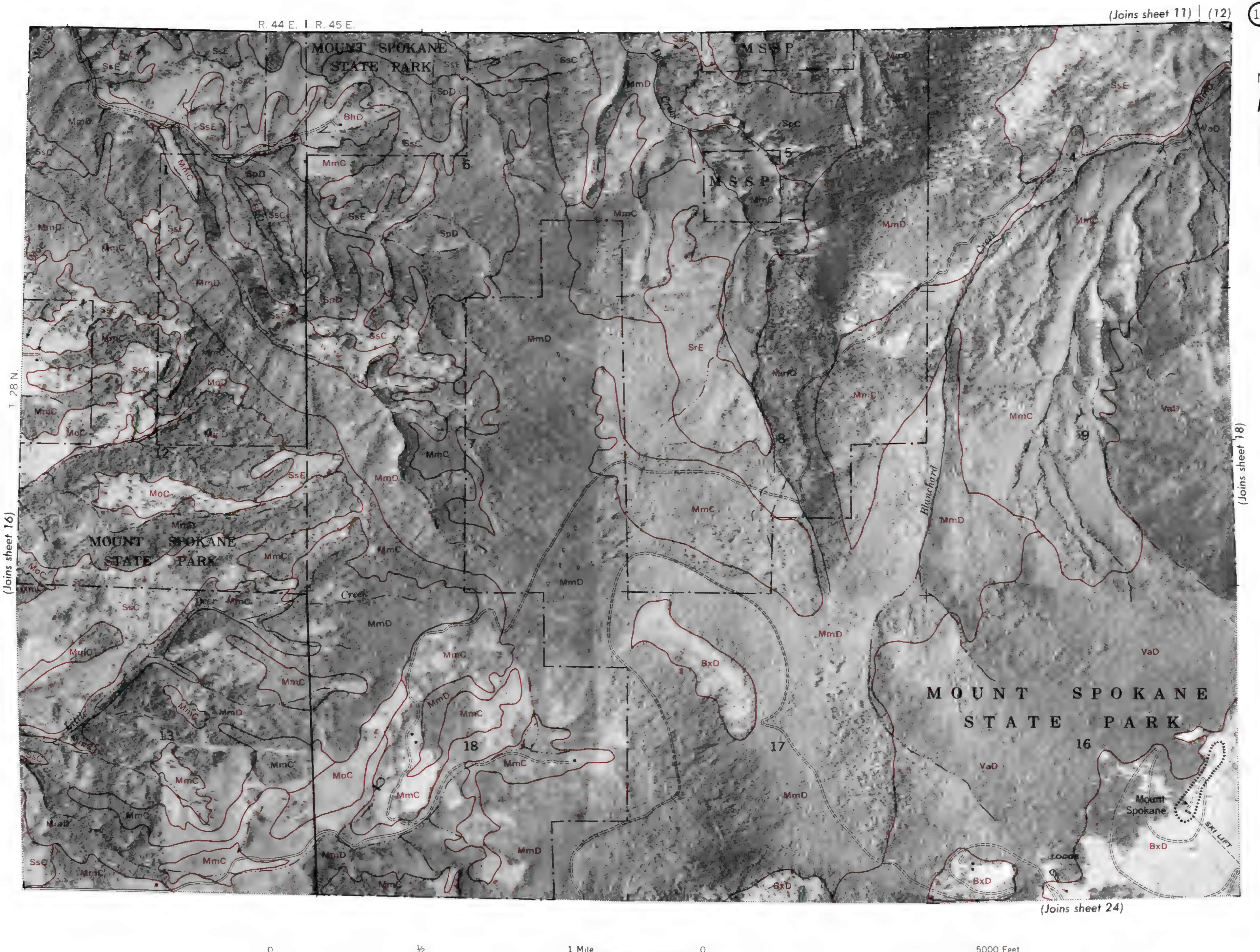
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

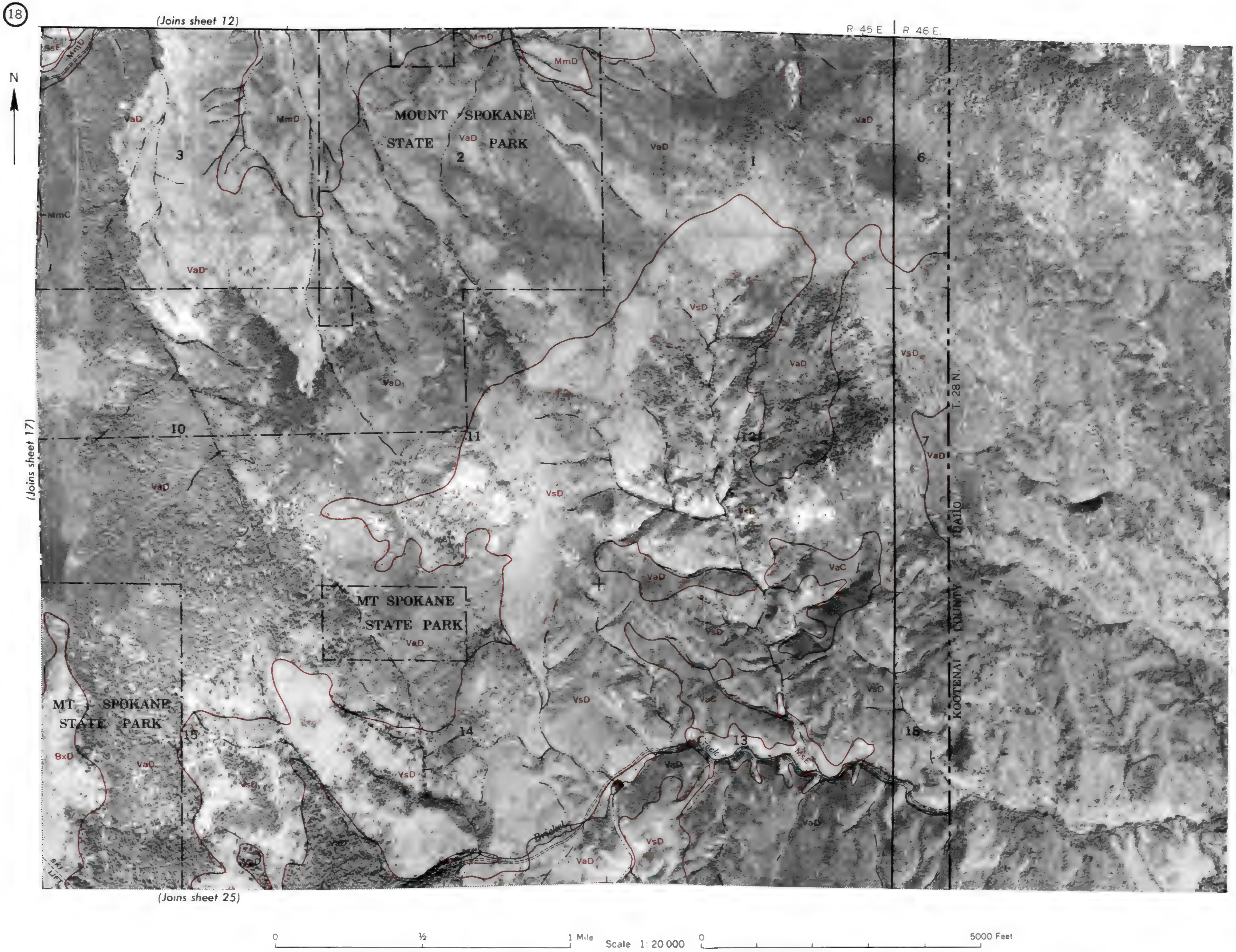


0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


18
(Joins sheet 12)
R 45 E.
R 46 E.
N
(Joins sheet 17)
(Joins sheet 25)
MOUNT SPOKANE
STATE PARK
MT SPOKANE
STATE PARK
MT SPOKANE
STATE PARK
T. 28 N.
KOOTENAI COUNTY
IDAHO
SsE
MmD
MmC
VaD
VsD
VaC
BxD
1
2
3
6
7
10
11
12
13
14
15
18
Brickel
Creek
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

19

N

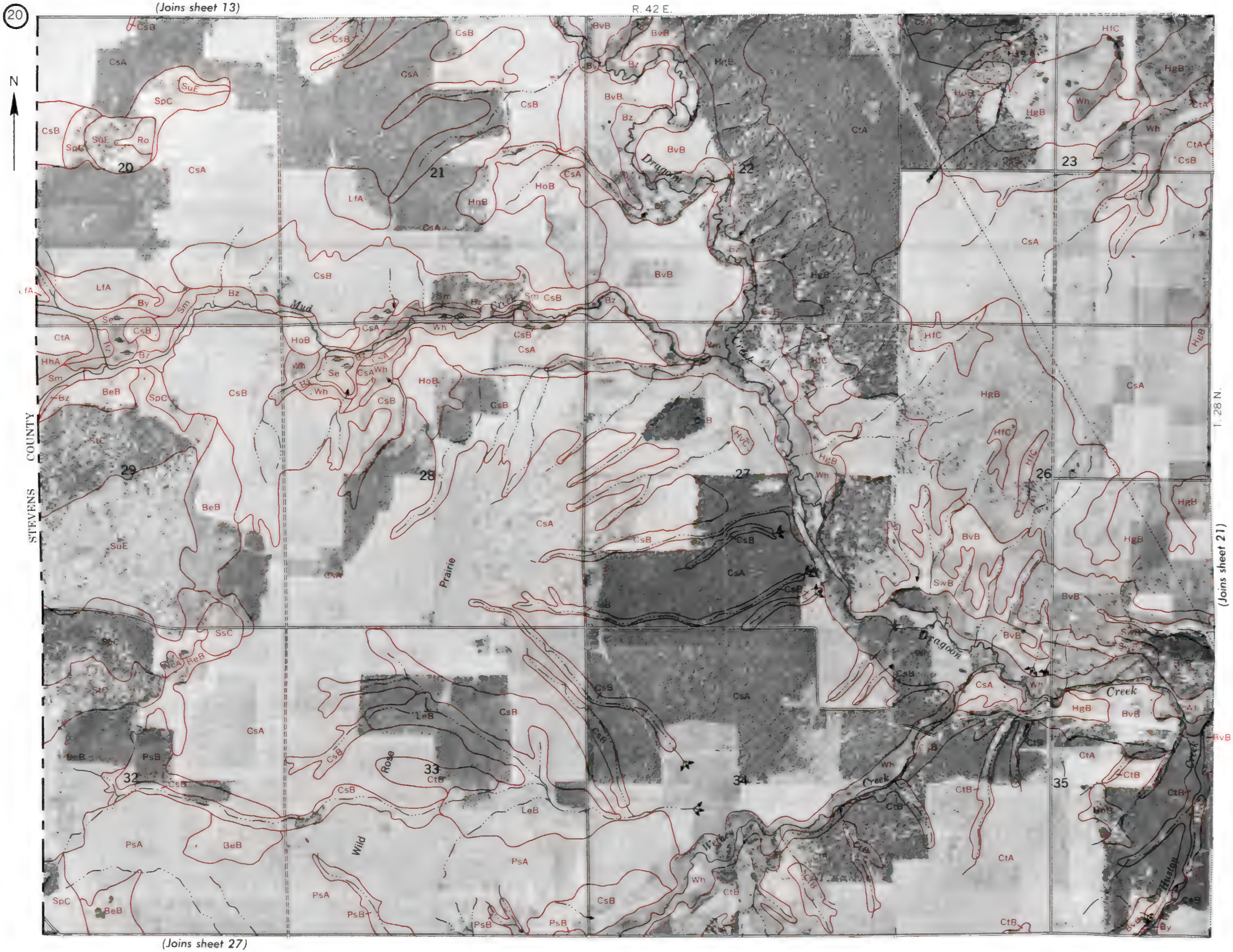
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

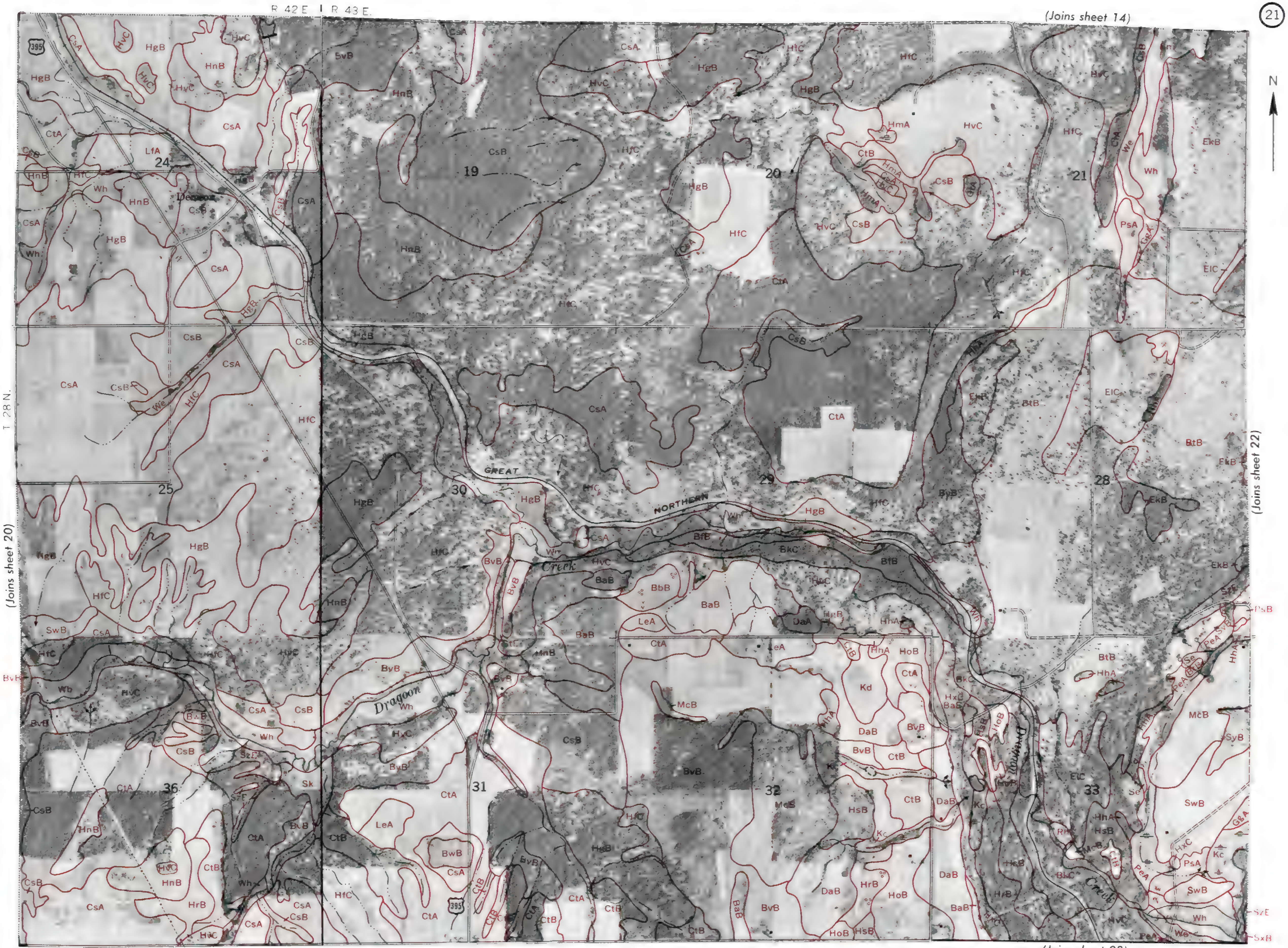
R. 40 E. | R. 41 E.

(Joins sheet 26)

0 ½ 1 Mile   Scale 1: 20 000   0 5000 Feet



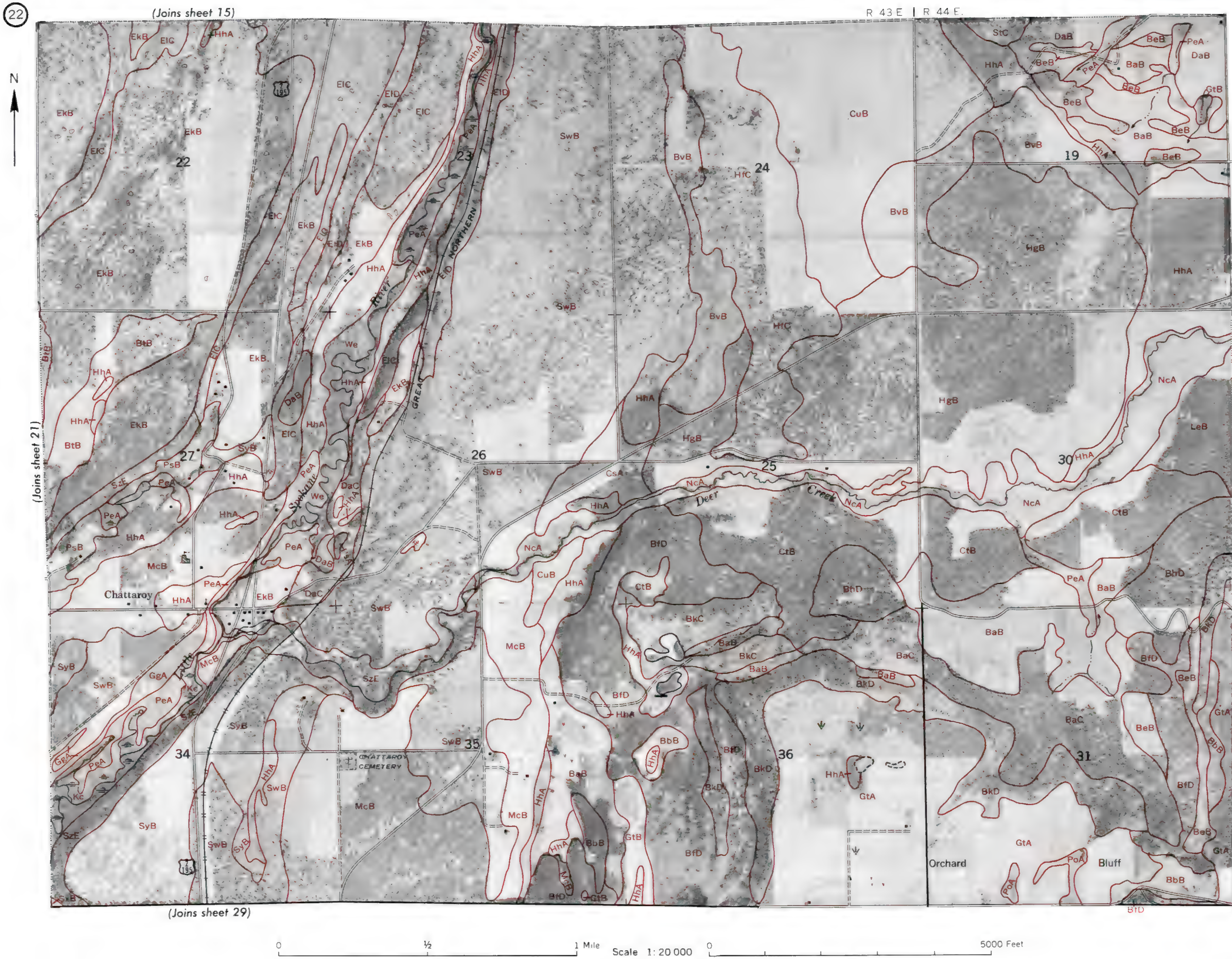
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



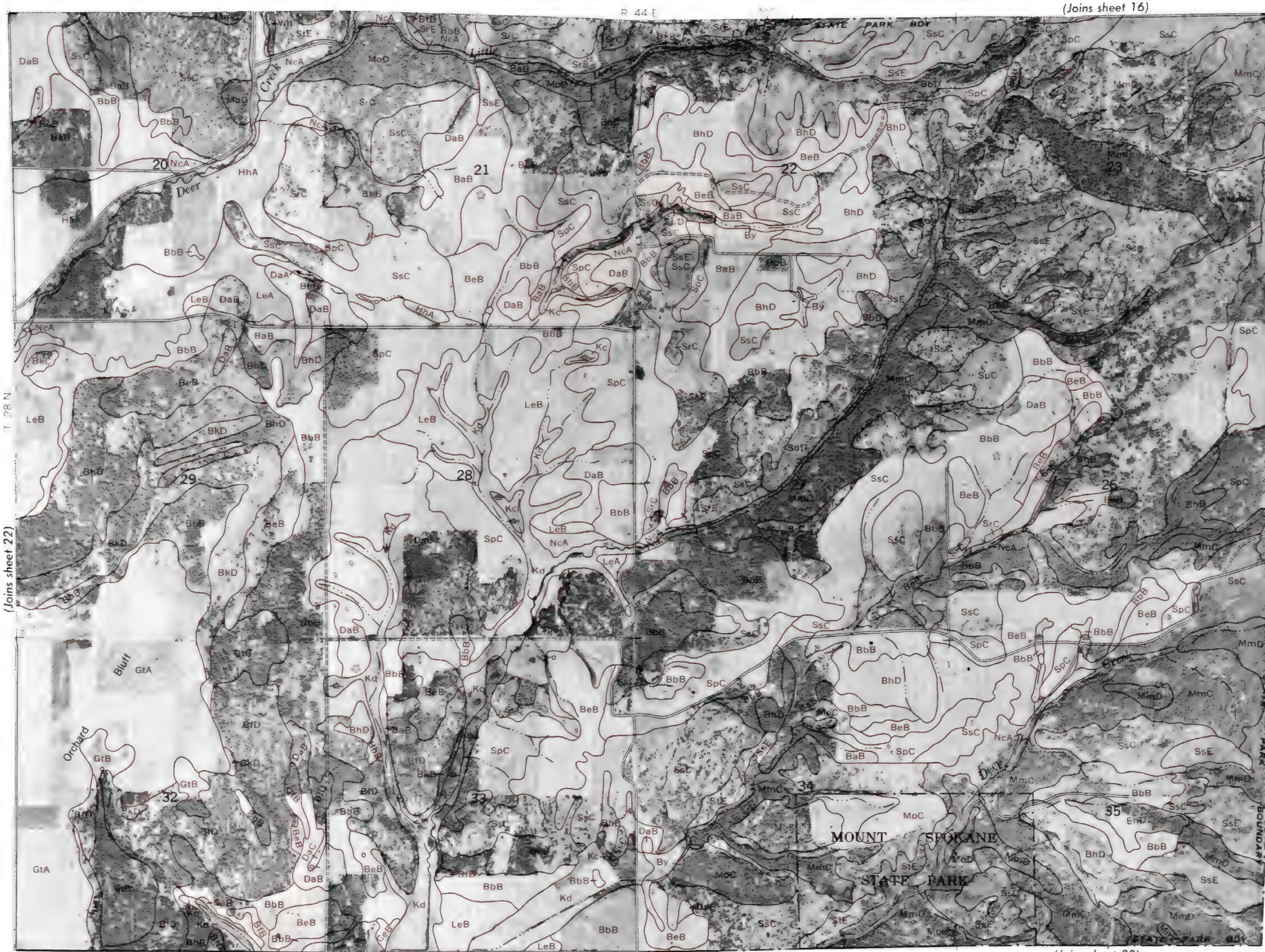
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


22
(Joins sheet 15)
R 43 E. | R 44 E.
N
(Joins sheet 21)
(Joins sheet 23)
T. 28 N.
(Joins sheet 29)
Chattaroy
CHATTAROY CEMETERY
Orchard Bluff
Spokane River
Little
Deer Creek
GREAT NORTHERN
195
22
23
24
19
27
26
25
30
34
35
36
31
Scale 1:20 000
0 ½ 1 Mile
0 5000 Feet

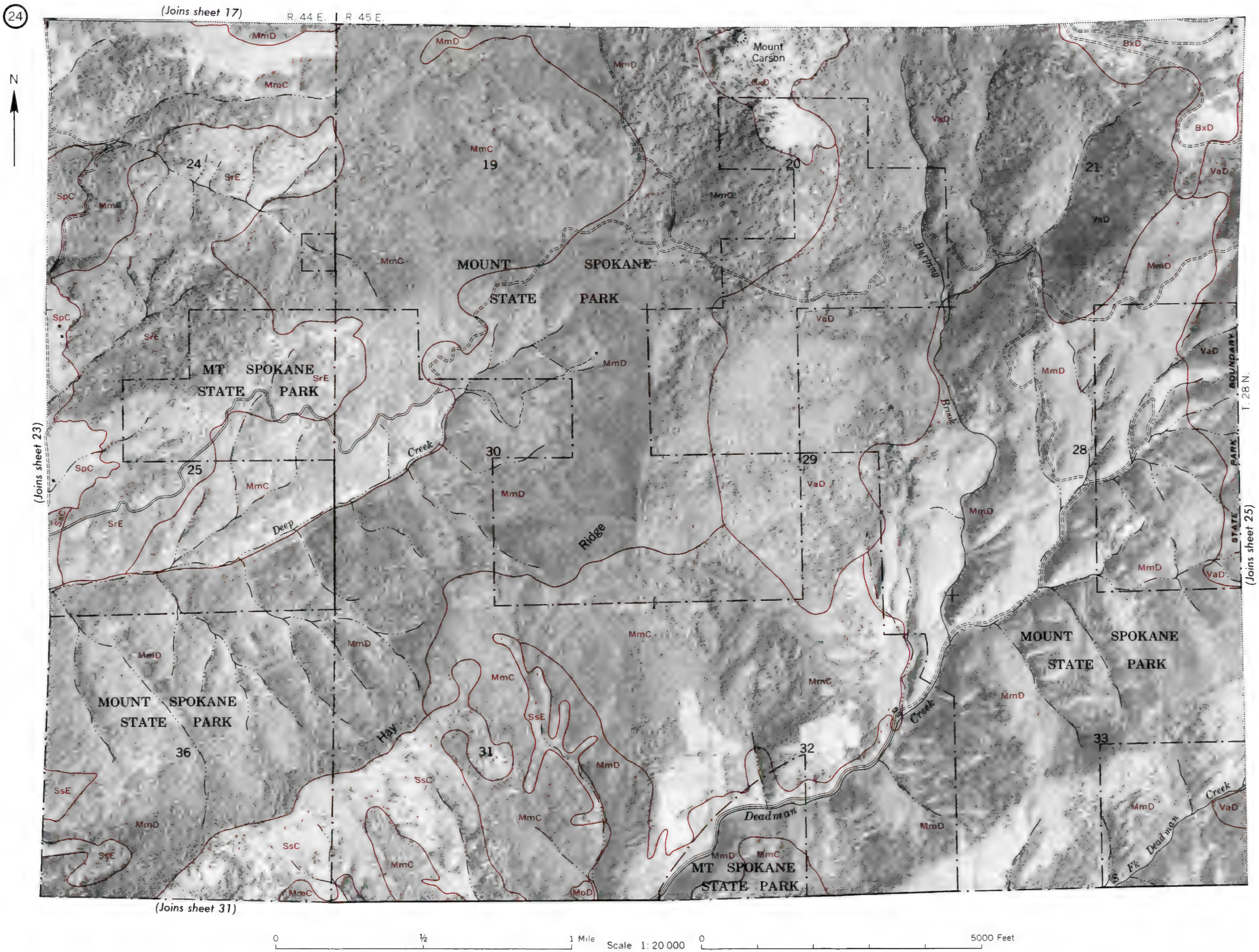
23



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

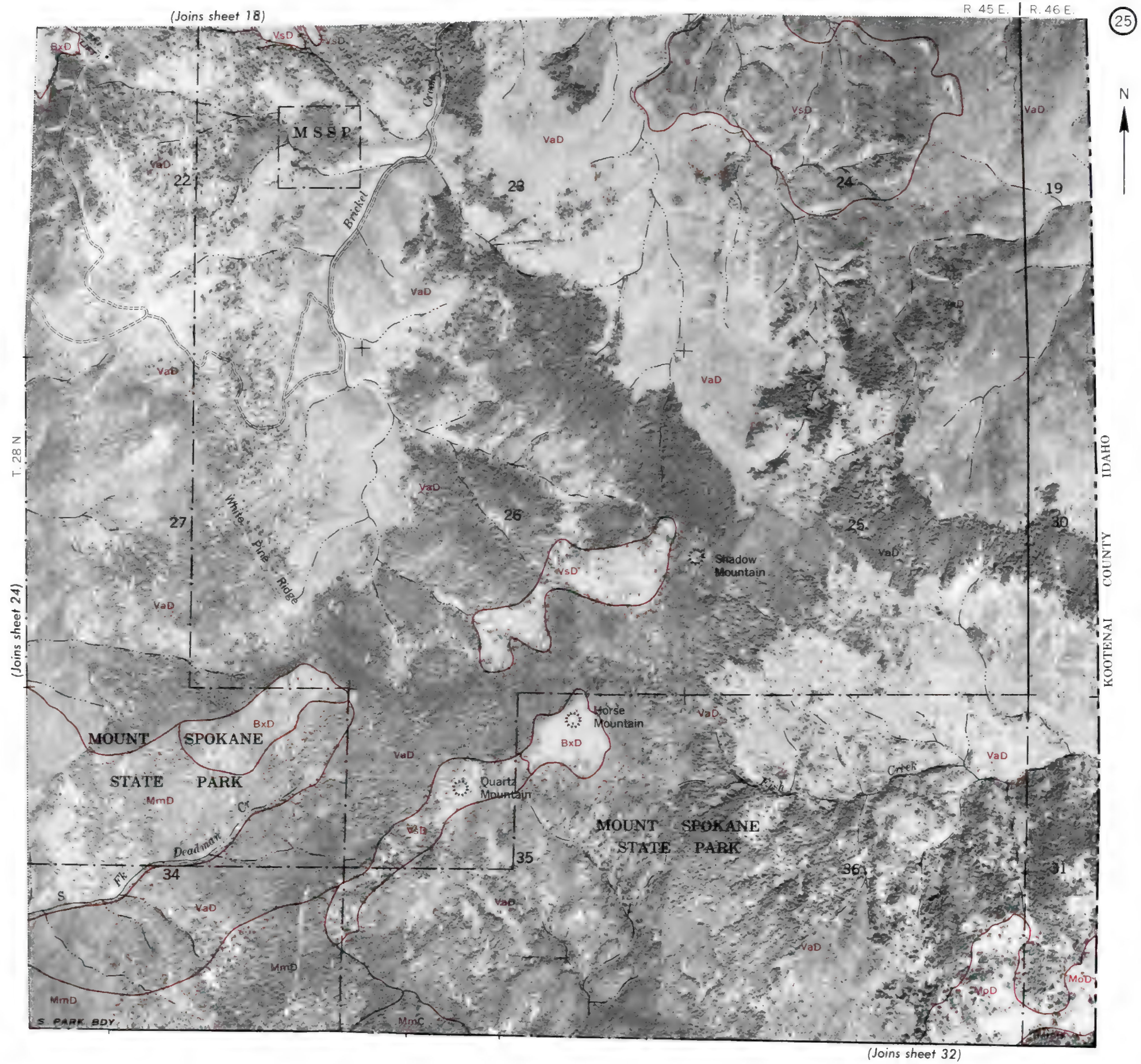
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite

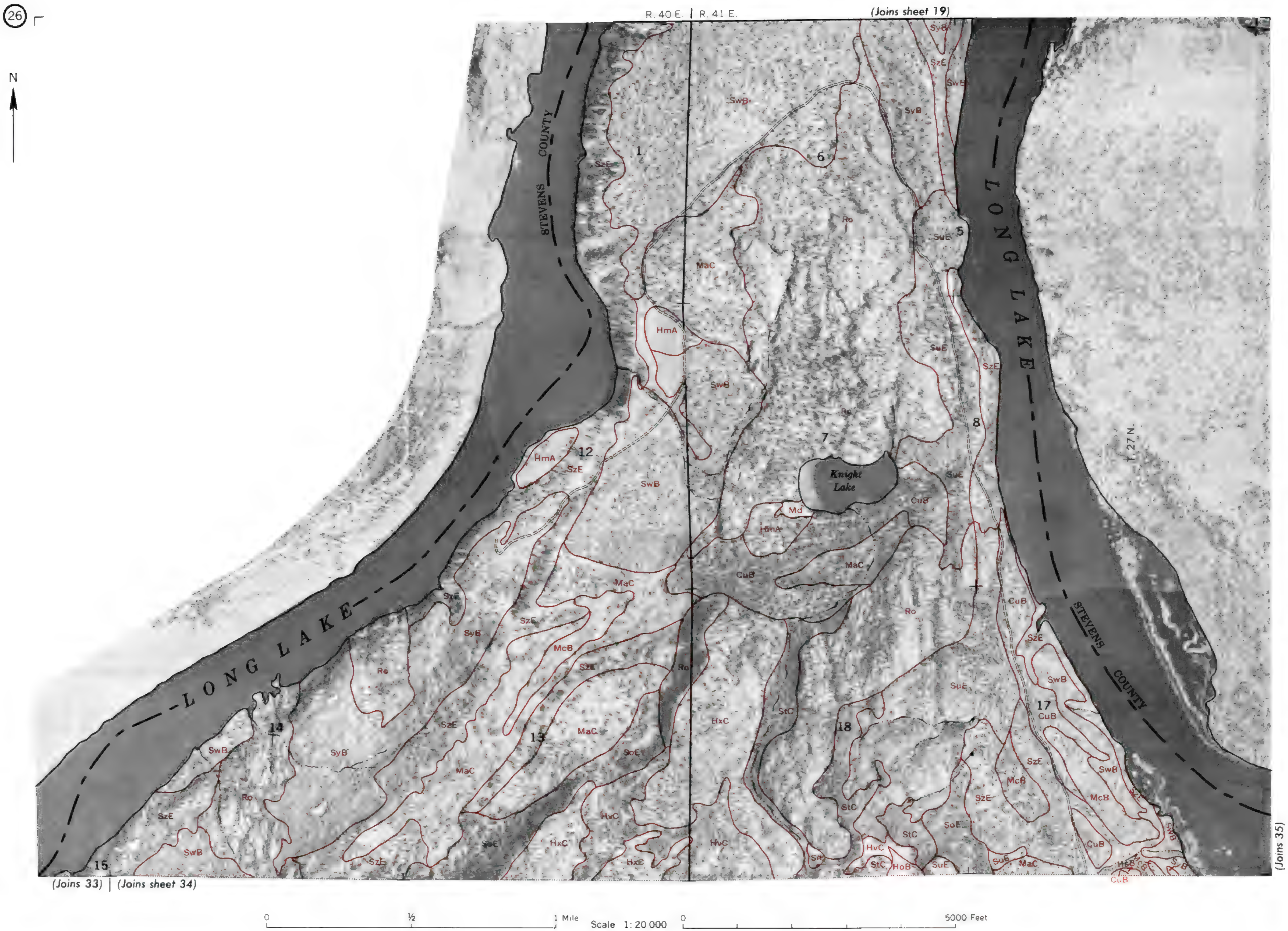

24
(Joins sheet 17)
R. 44 E.
R. 45 E.
N
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
T. 28 N.
Mount Carson
MOUNT SPOKANE STATE PARK
MT SPOKANE STATE PARK
STATE PARK BOUNDARY
Deep Creek
Ridge
Burping Brook
Hay Creek
Deadman Creek
S. Fk Deadman Creek
19
20
21
24
25
28
29
30
31
32
33
36
MmD
MmC
SrE
SpC
SsC
SsE
VaD
BxD
MoD
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

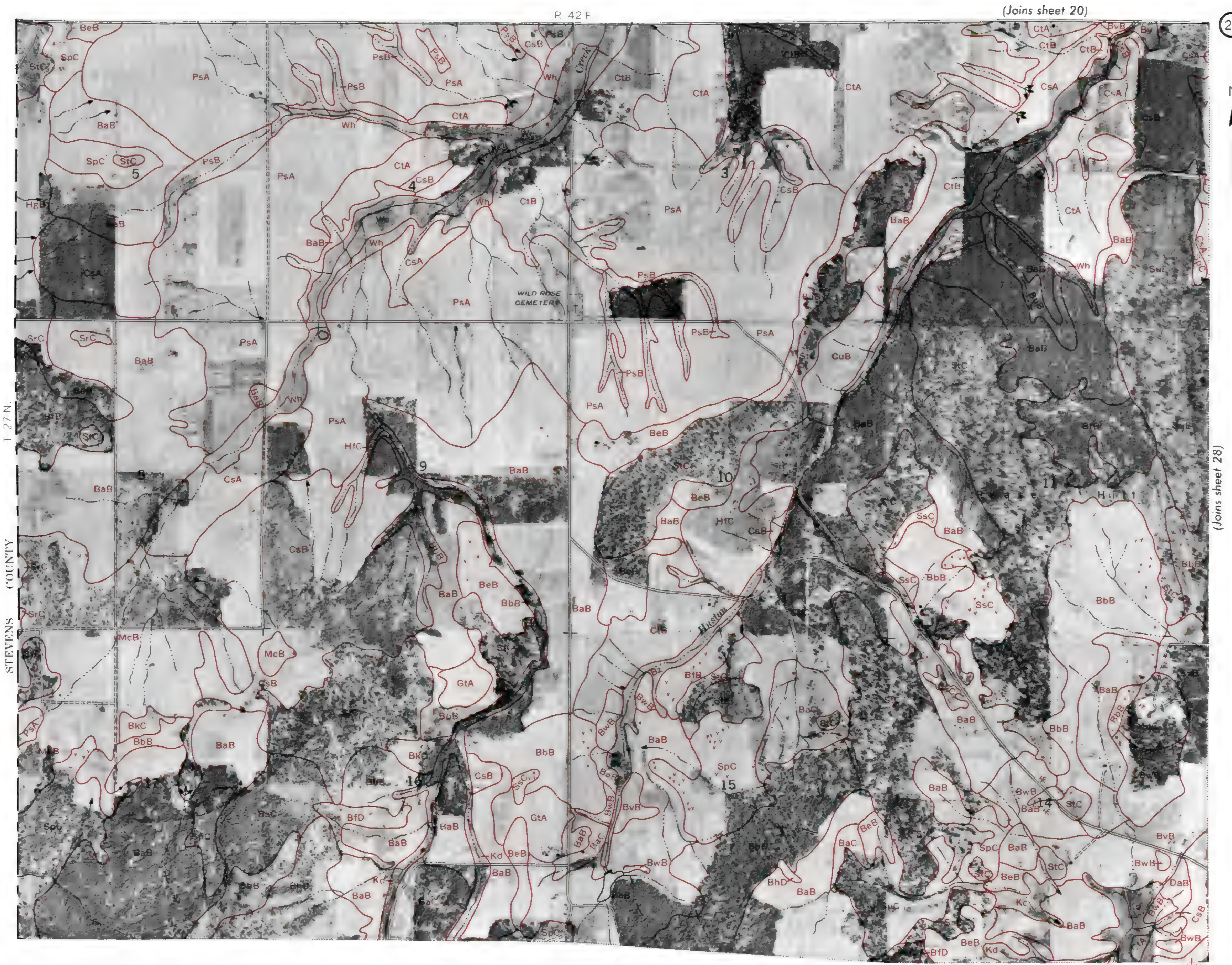
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


26
N
R. 40 E.
R. 41 E.
(Joins sheet 19)
STEVENS COUNTY
LONG LAKE
Knight Lake
T. 27 N.
(Joins 33)
(Joins sheet 34)
(Joins 35)
SwB
SyB
SzE
MaC
HmA
Ro
SuE
CuB
Md
McB
HxC
HvC
StC
SoE
HoB
1
5
6
7
8
12
13
14
15
17
18
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled ... as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

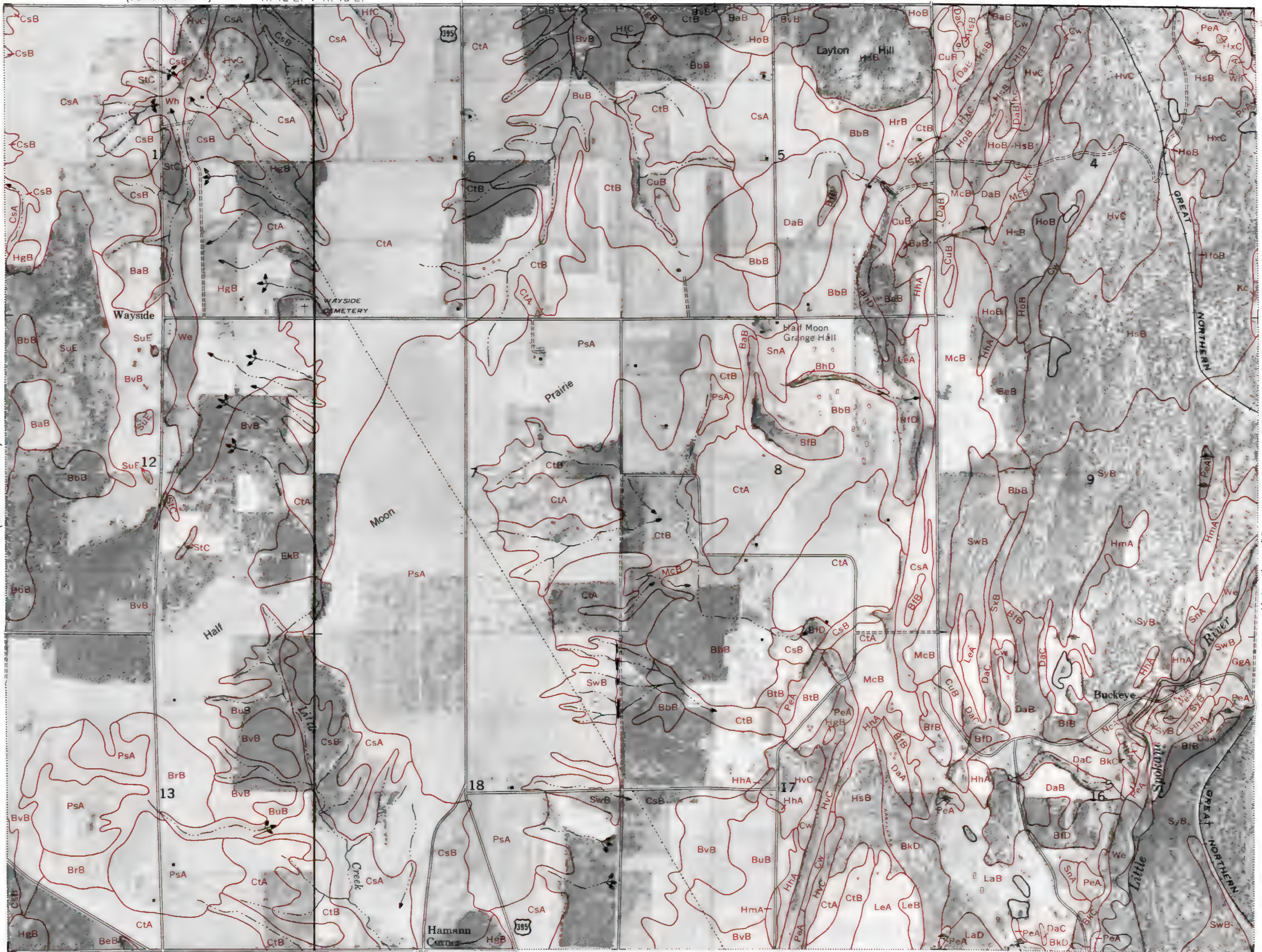
Range, township, and section corners shown on this map are indefinite.

28

(Joins sheet 21)

R. 42 E. | R. 43 E.

N



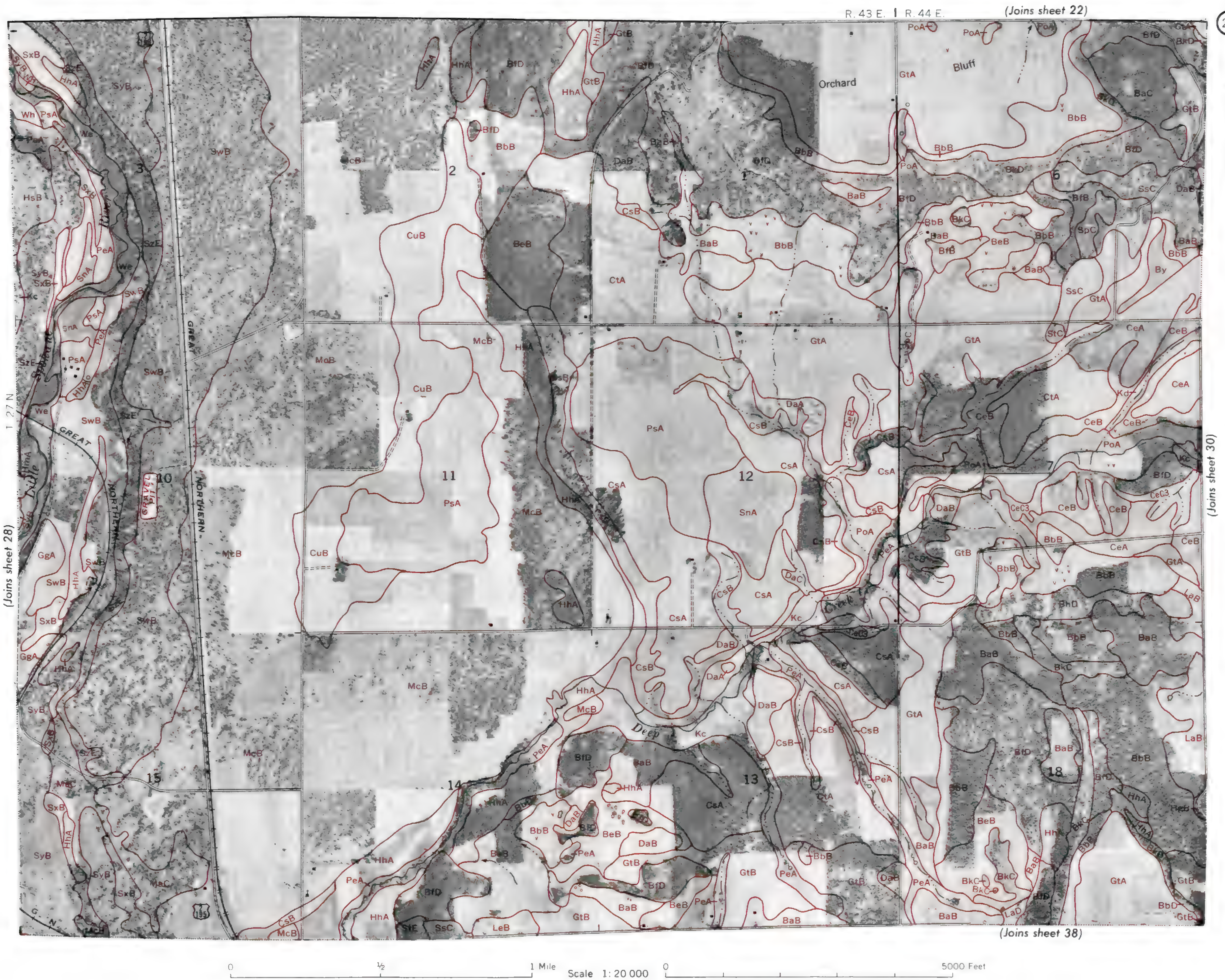
(Joins sheet 27)

(Joins sheet 29)

T. 27 N.

(Joins sheet 37)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



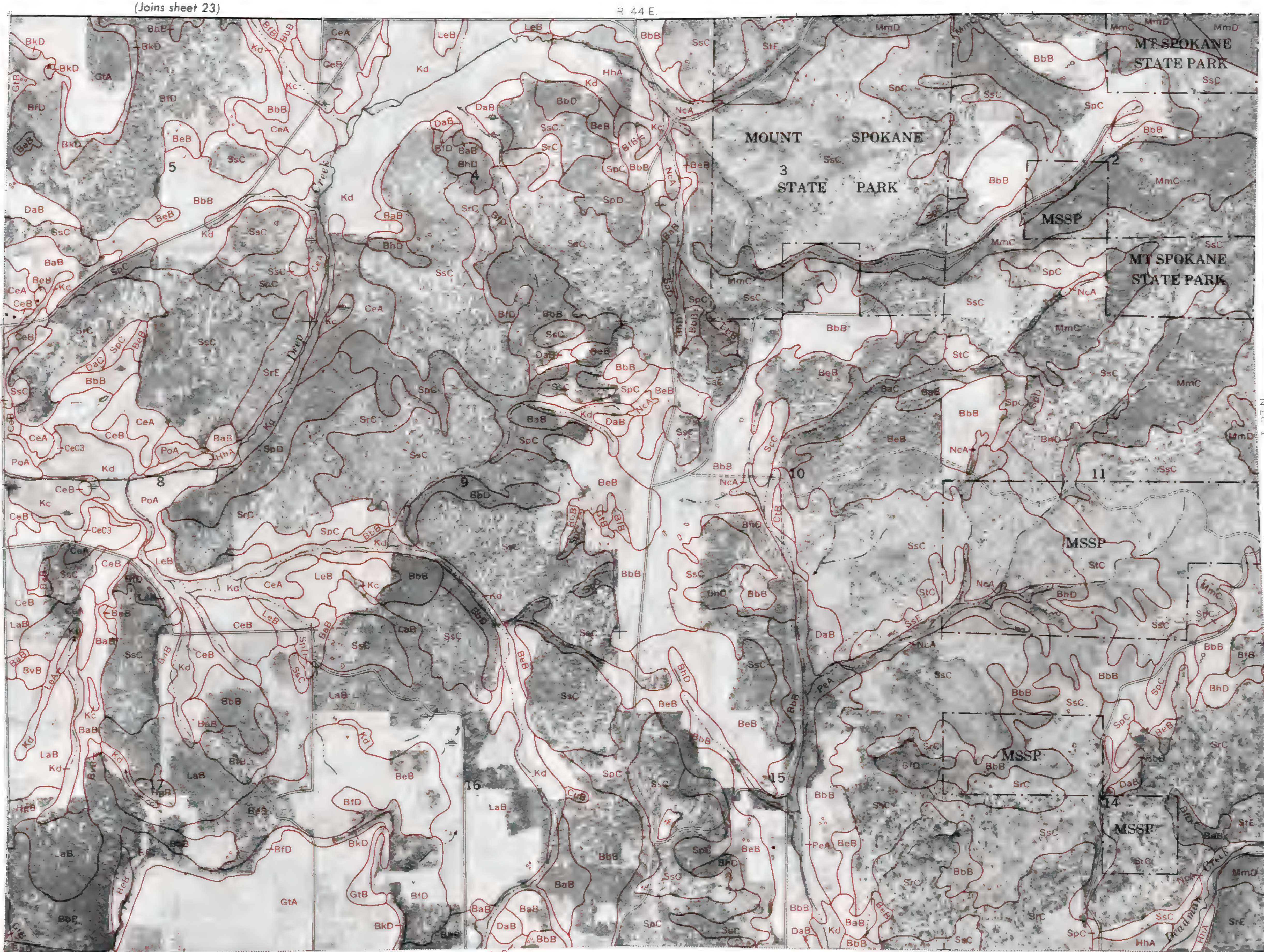
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

30

(Joins sheet 23)

R. 44 E.

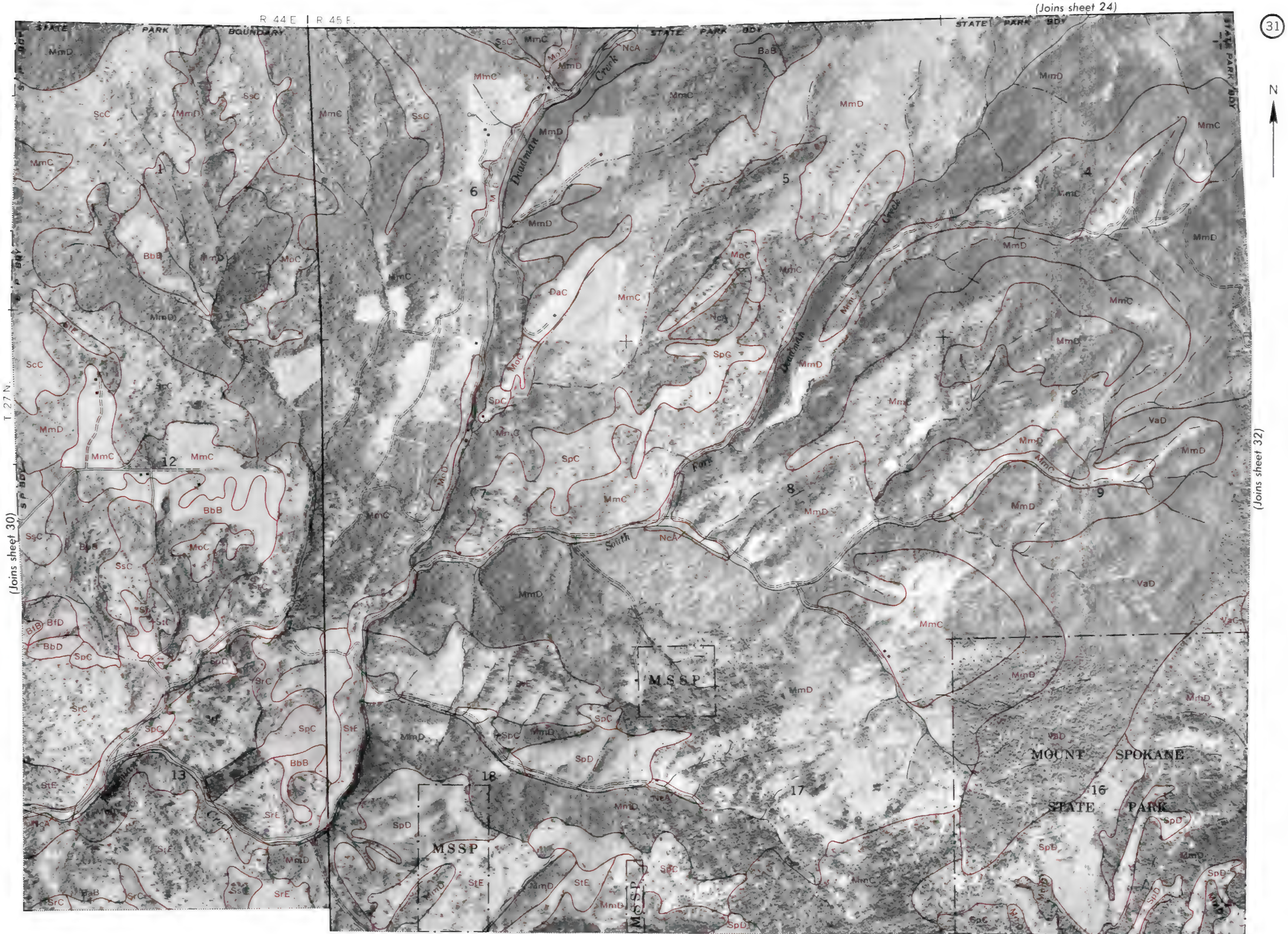


(Joins sheet 29)

(Joins sheet 31)

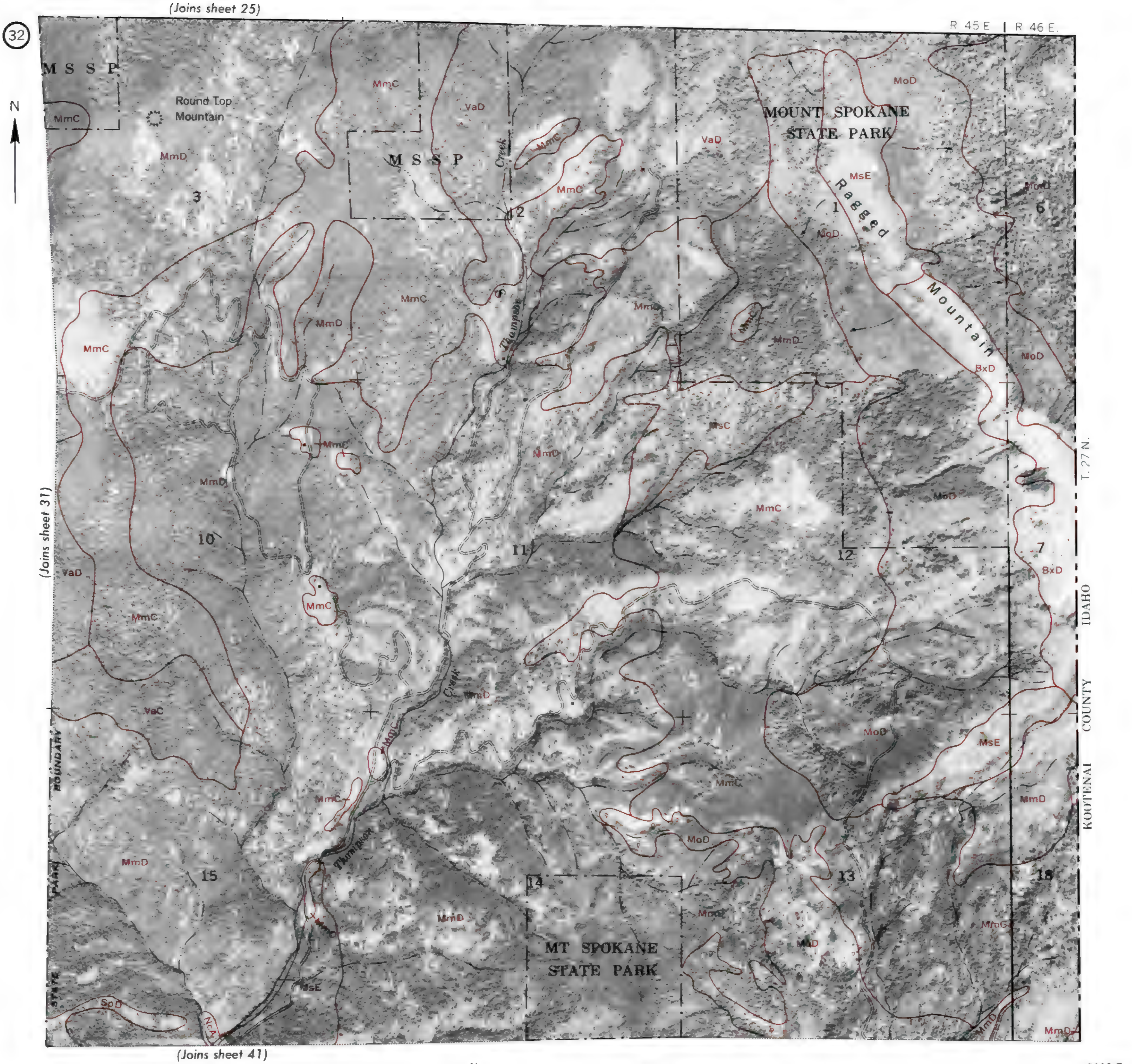
(Joins sheet 39)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



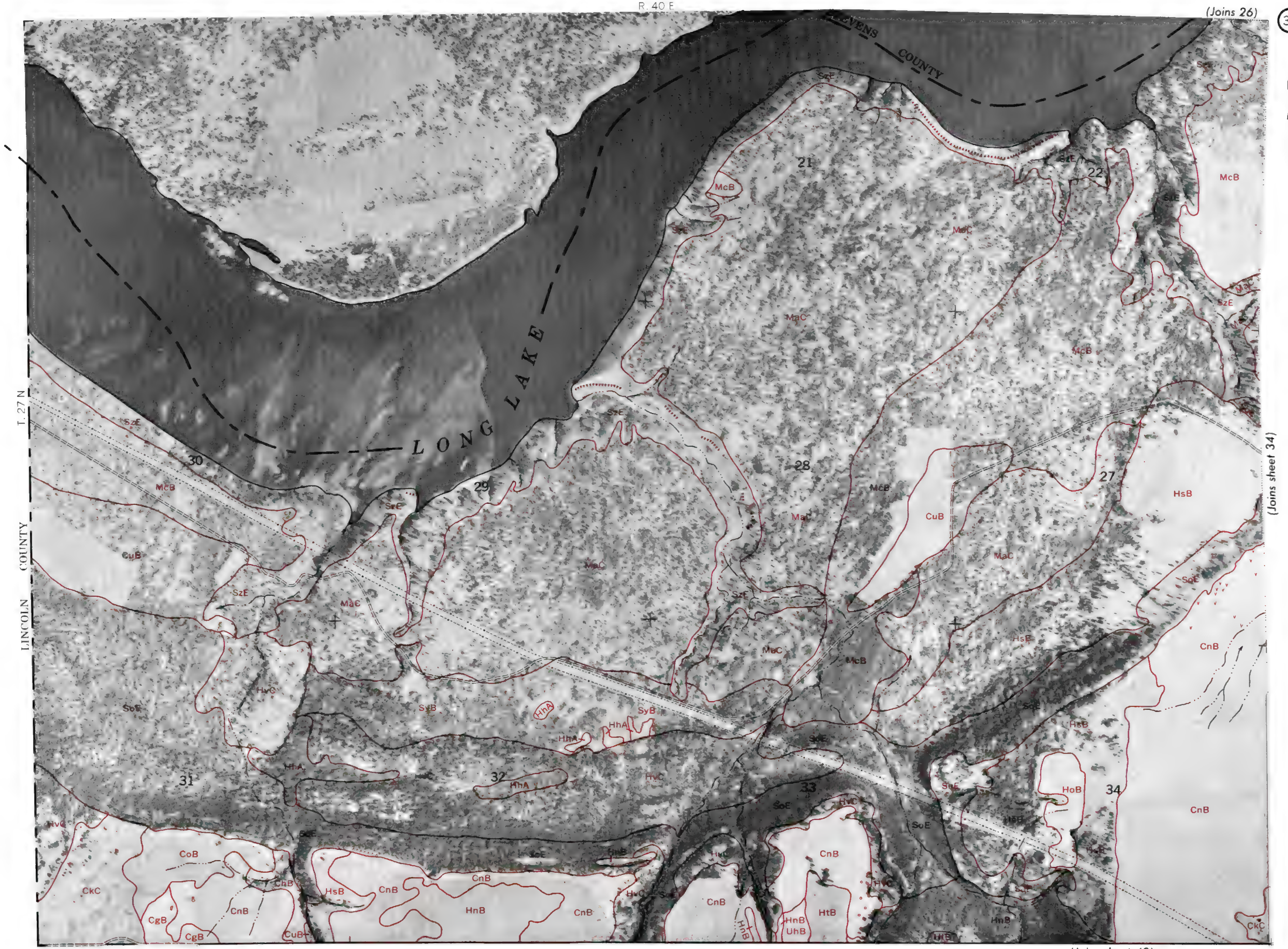
Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



(Joins sheet 41)

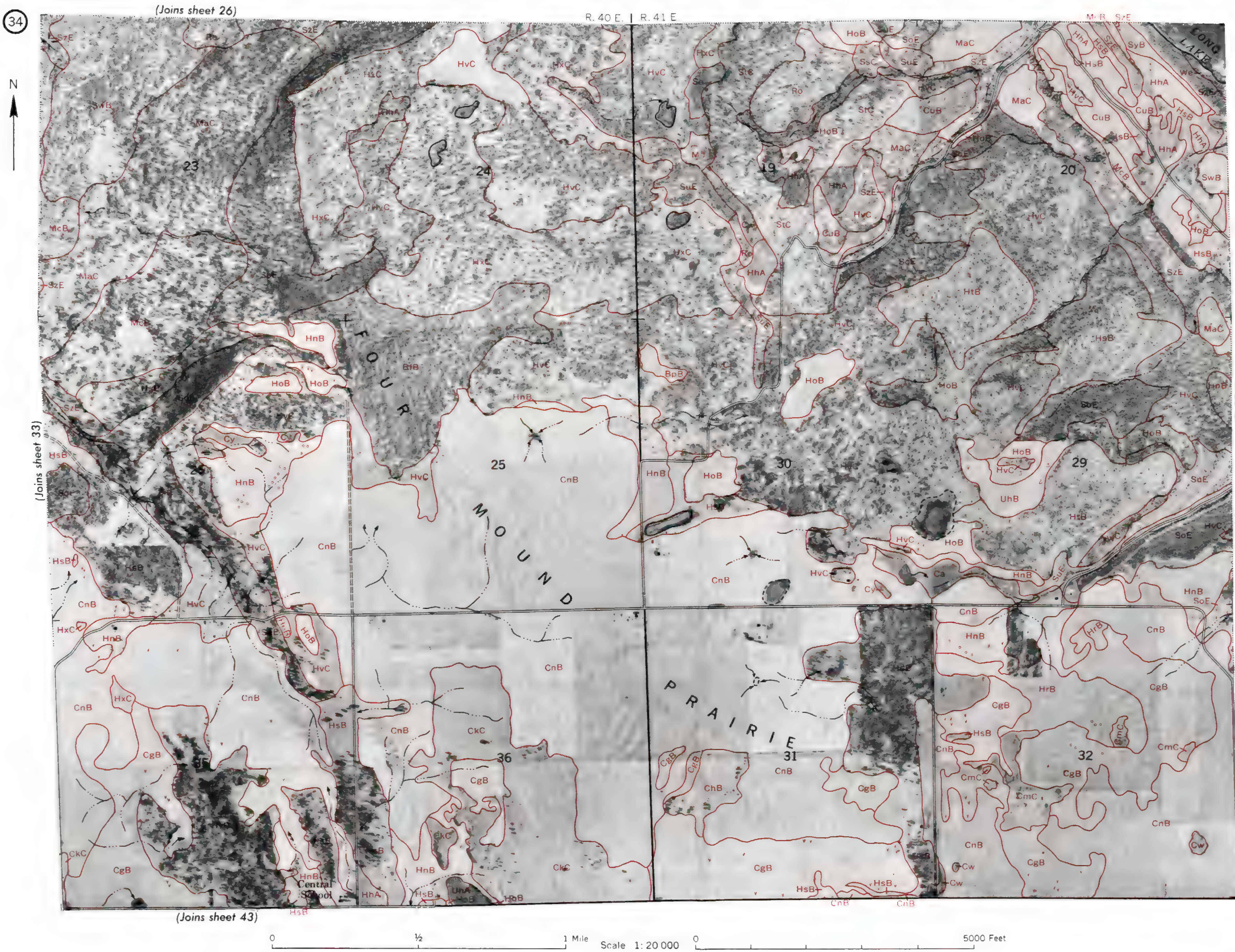
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

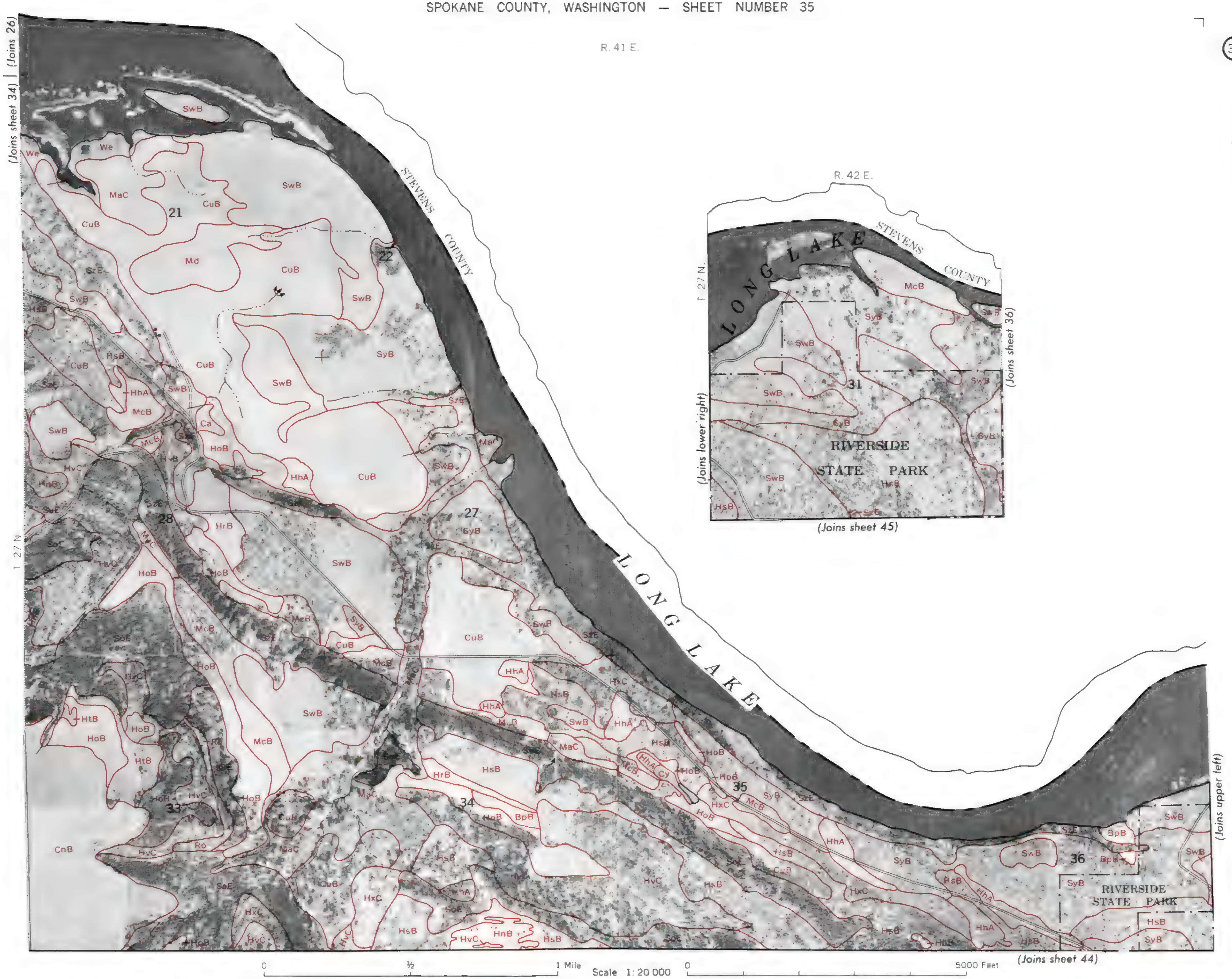


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

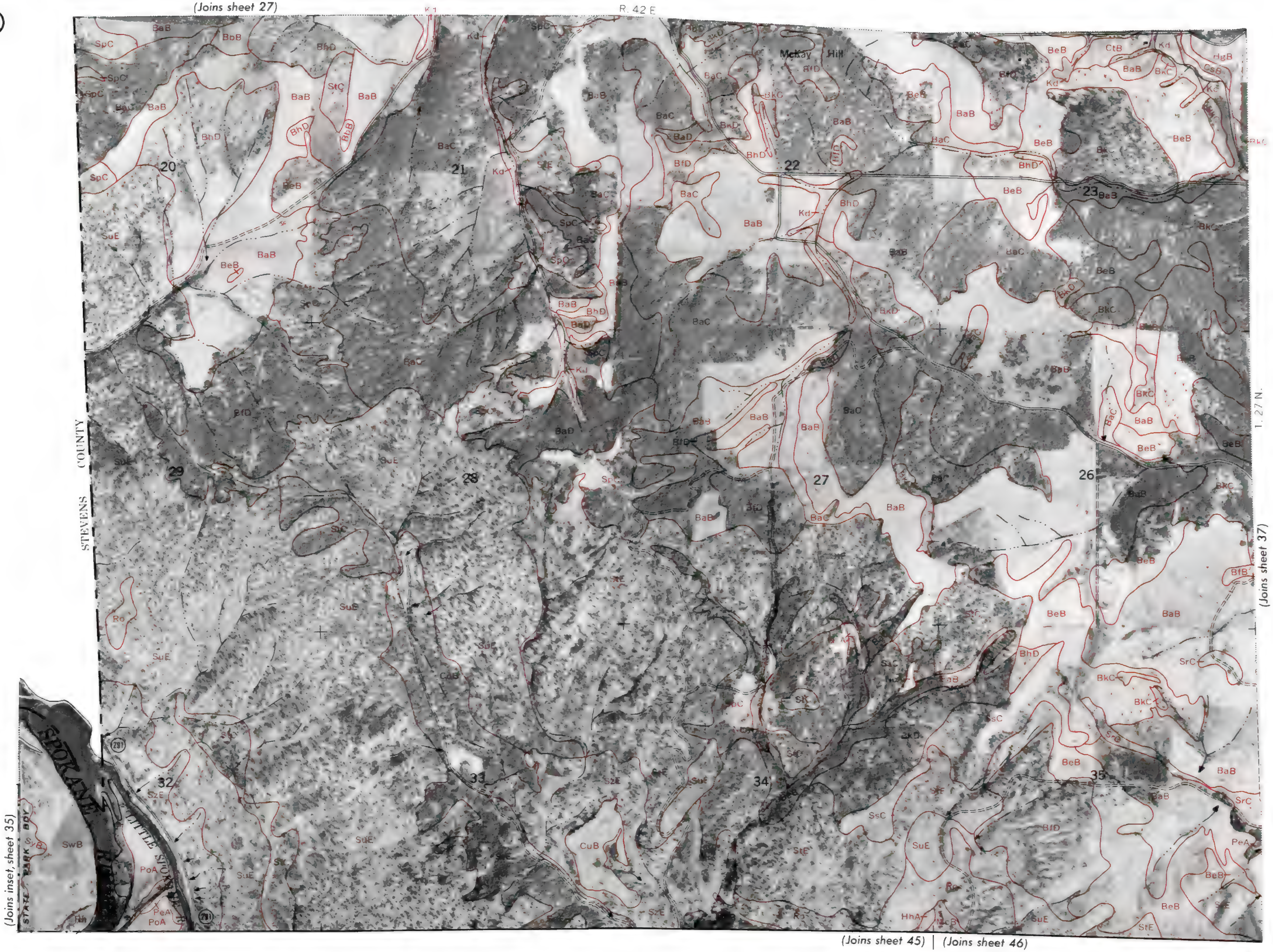
Range, township, and section corners shown on this map are indefinite


34
(Joins sheet 26)
R. 40 E. | R. 41 E.
N
FOUR MOUND PRAIRIE
LONG LAKE
T. 27 N.
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 43)
Central School
23
24
19
20
25
30
29
36
31
32
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

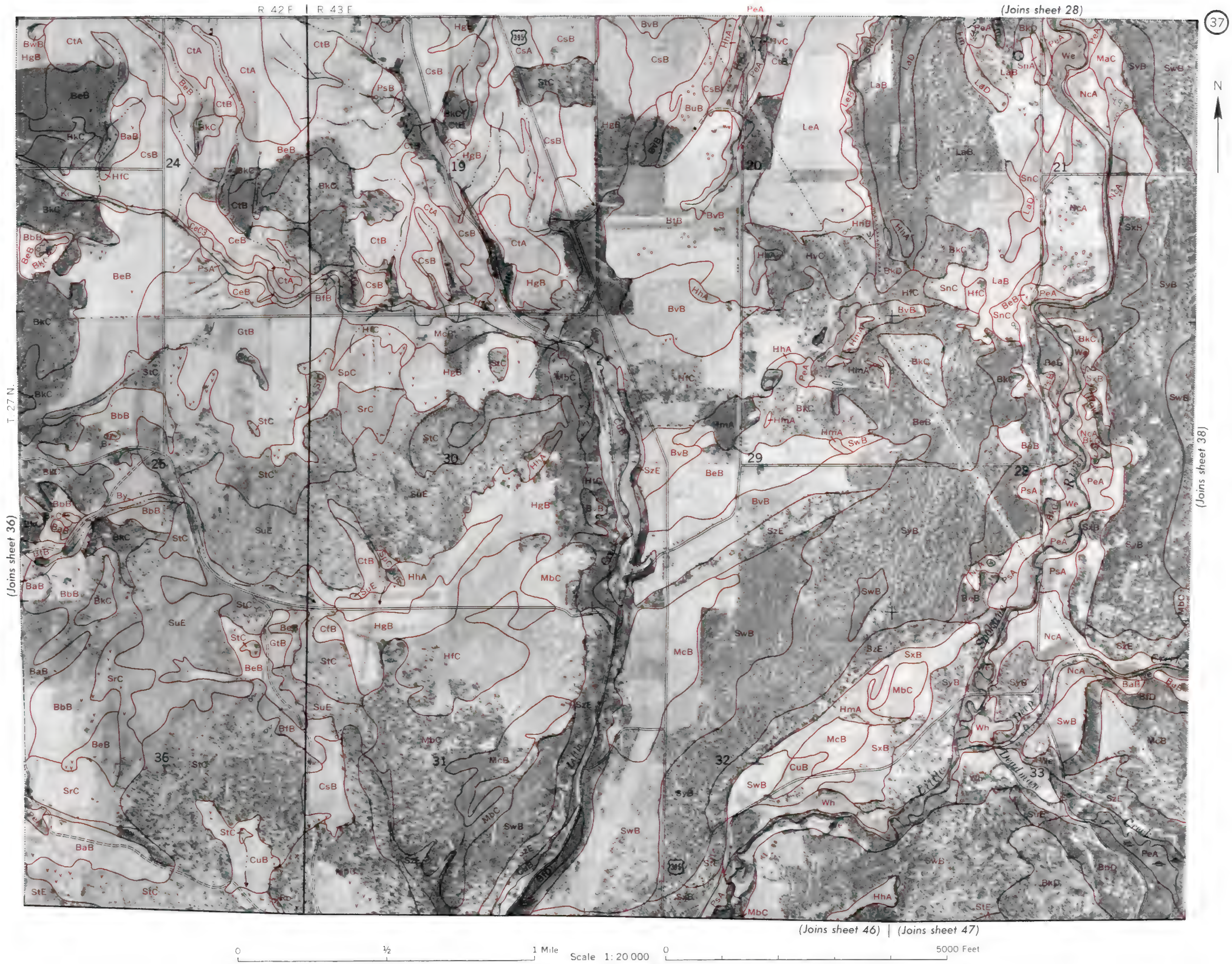


This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

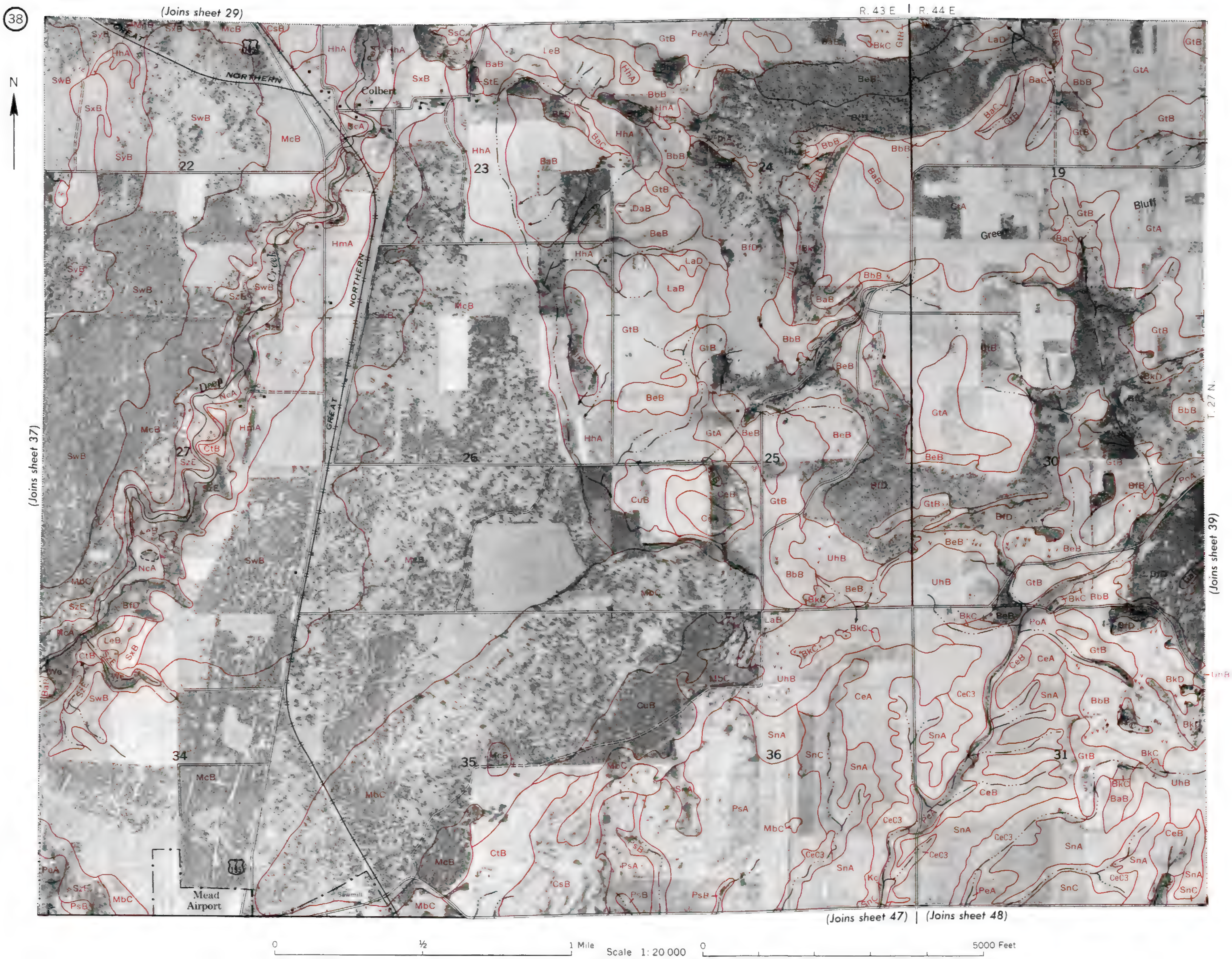


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


38
(Joins sheet 29)
R. 43 E. | R. 44 E.
N
Colbert
GREAT NORTHERN
Deep Creek
Green Bluff
T. 27 N.
(Joins sheet 37)
(Joins sheet 39)
22
23
24
19
27
26
25
30
34
35
36
31
Mead Airport
Sawmill
(Joins sheet 47) | (Joins sheet 48)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 39

(39)

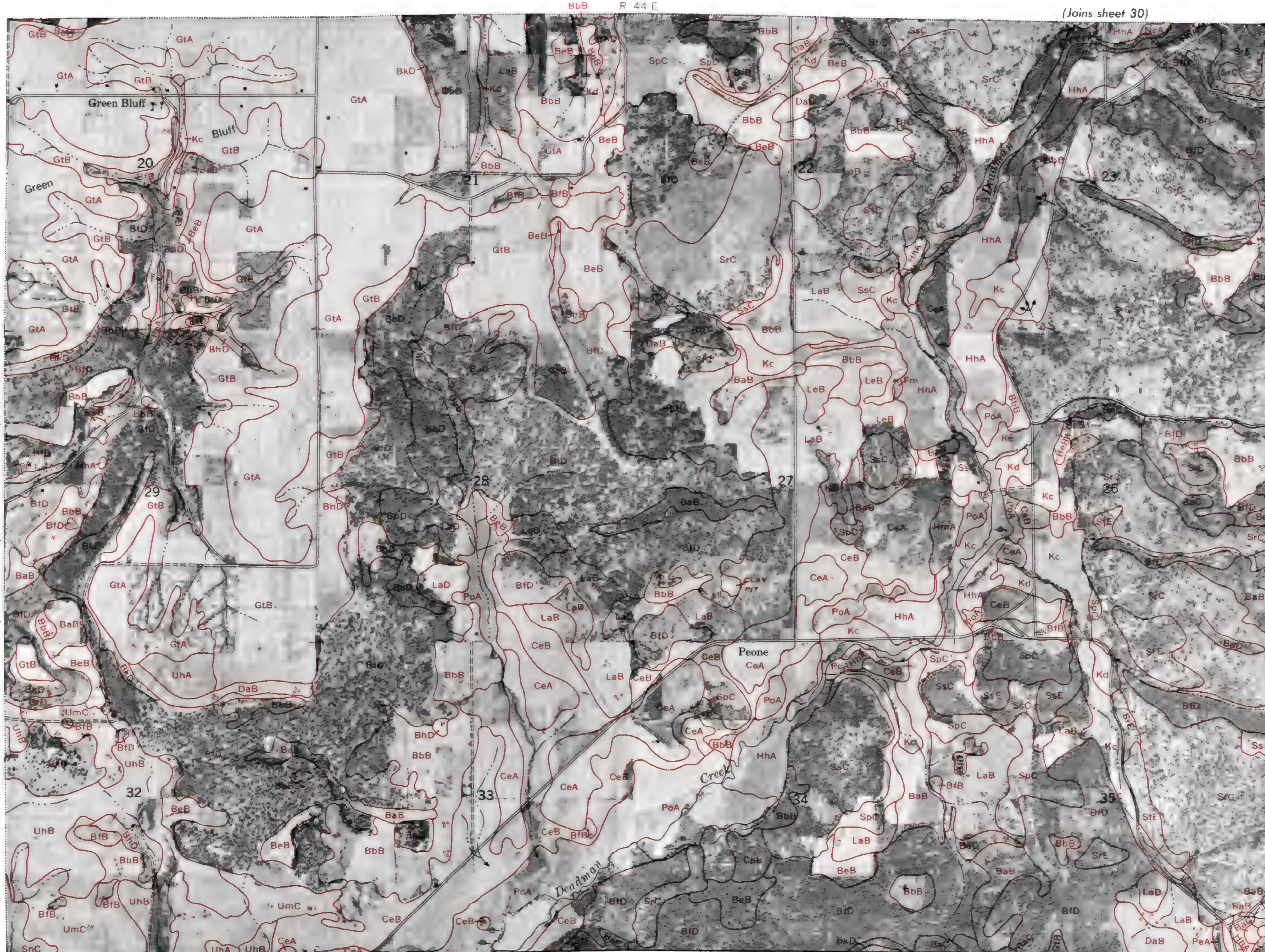
R. 44 E.

(Joins sheet 30)

T. 27 N.

(Joins sheet 38)

(Joins sheet 40)



(Joins sheet 48) | (Joins sheet 49)

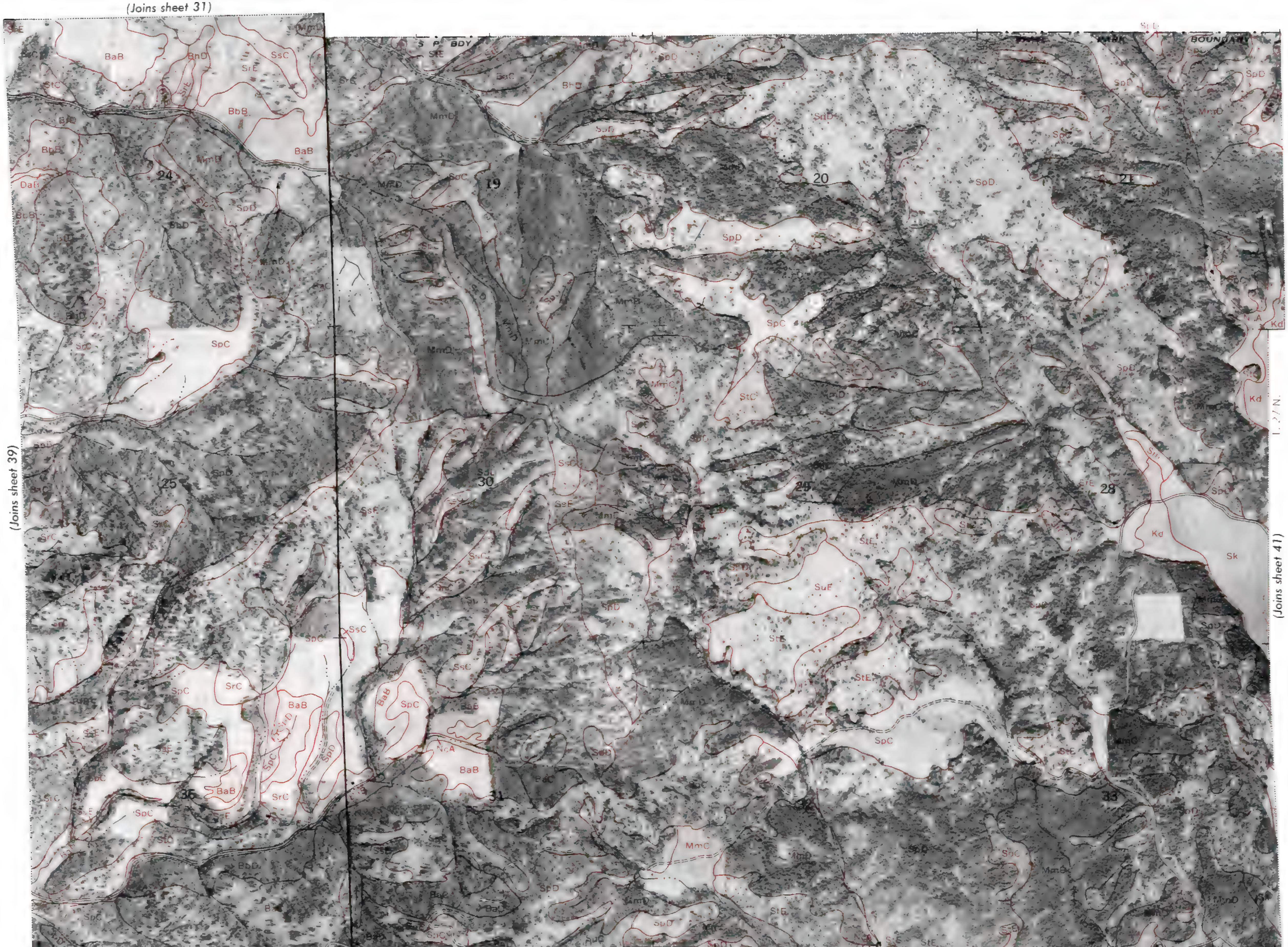
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

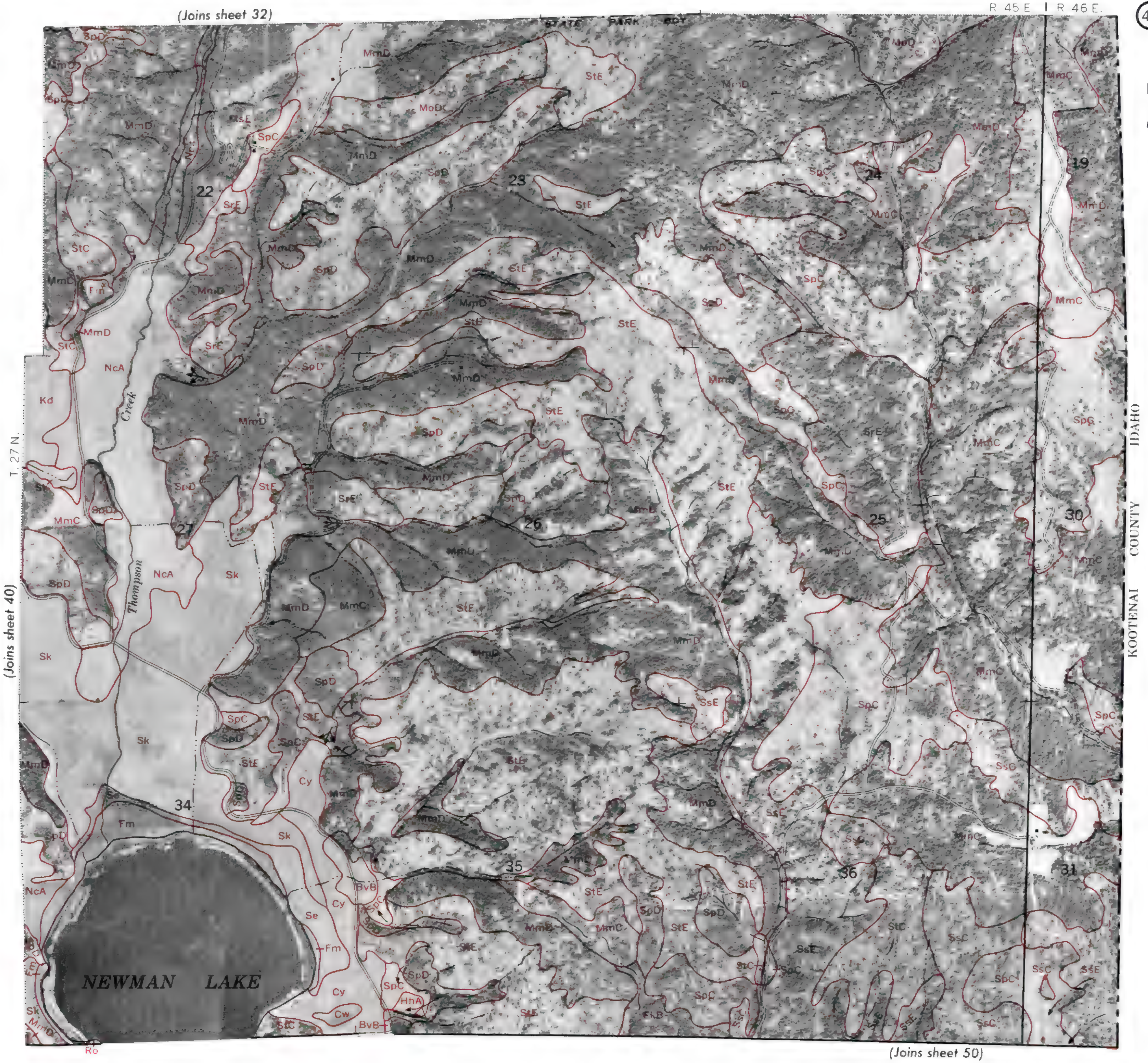
40

(Joins sheet 31)



(Joins sheet 49) | (Joins sheet 50)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



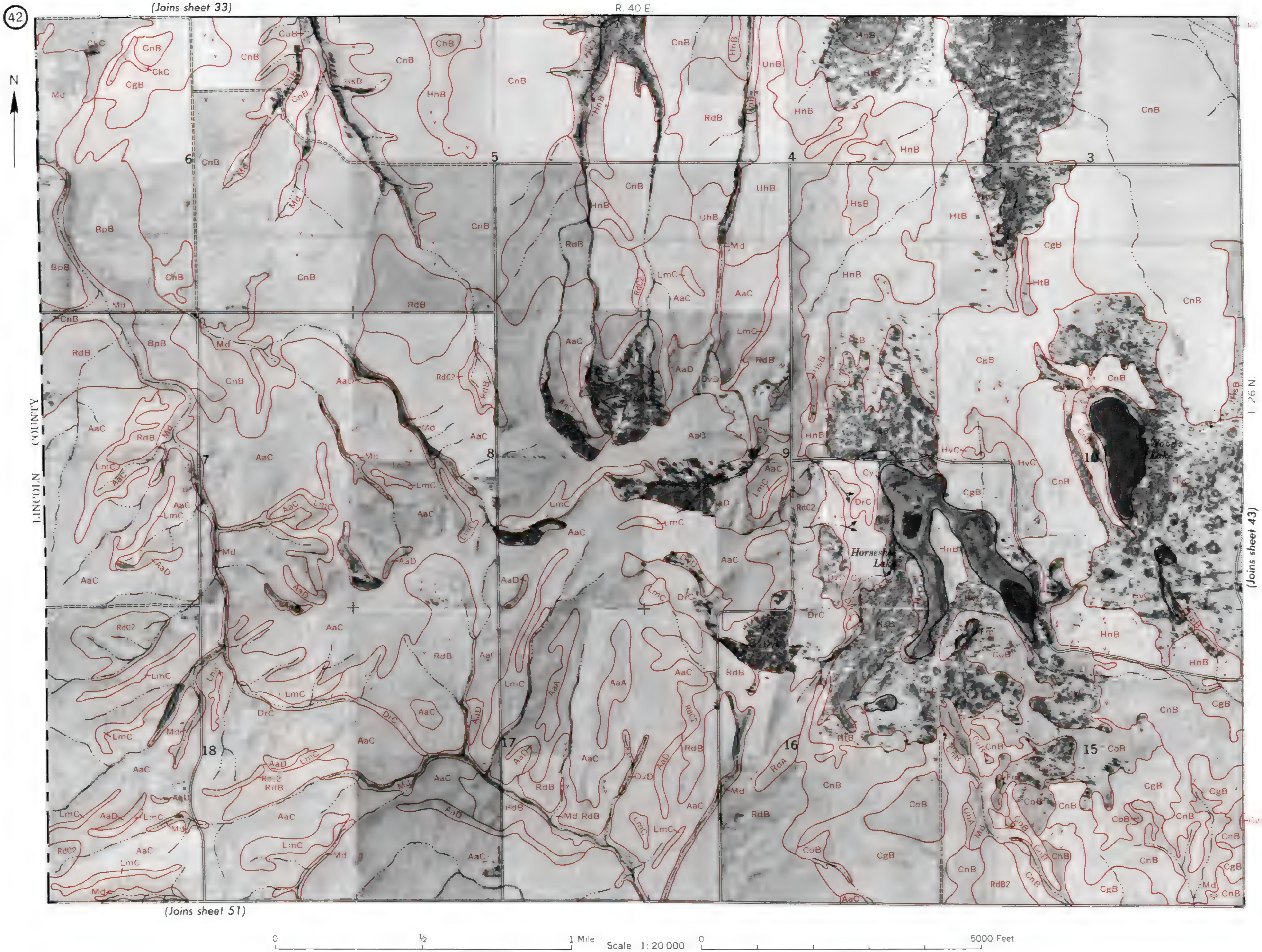
Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

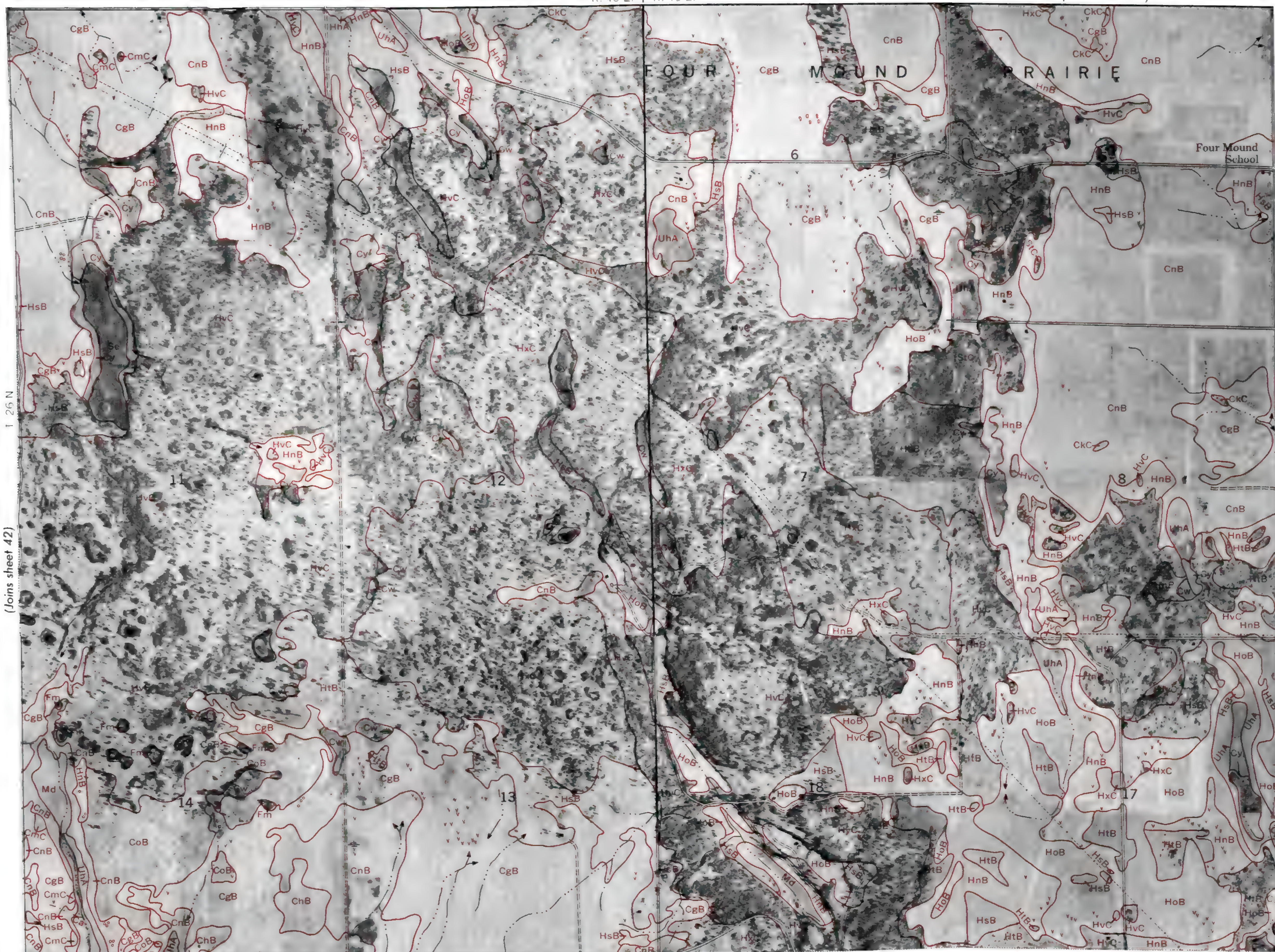
Range, township, and section corners shown on this map are indefinite


42
(Joins sheet 33)
R. 40 E.
T. 26 N.
(Joins sheet 43)
(Joins sheet 51)
LINCOLN COUNTY
N
Horseshoe Lake
Woods Lake
6
5
4
3
7
8
9
10
18
17
16
15
CnB
CkC
CgB
Md
HsB
HnB
CbB
RdB
UhB
HtB
BpB
AaC
AaD
LmC
RdC2
DvD
Cy
DrC
HvC
CoB
AaA
RdA
RdB2
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

R. 40 E. | R. 41 E.

(Joins sheet 34)

43

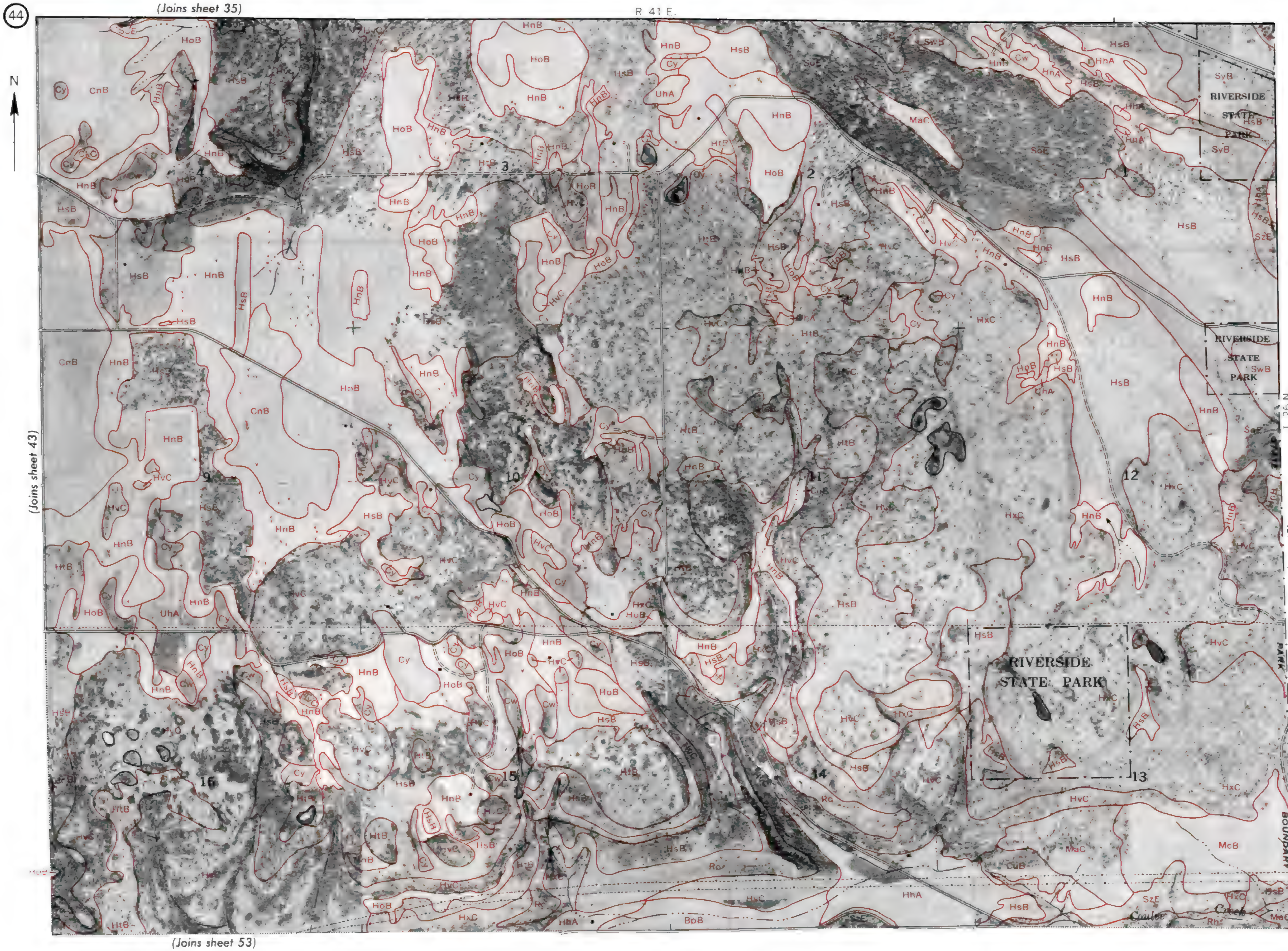


(Joins sheet 52)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

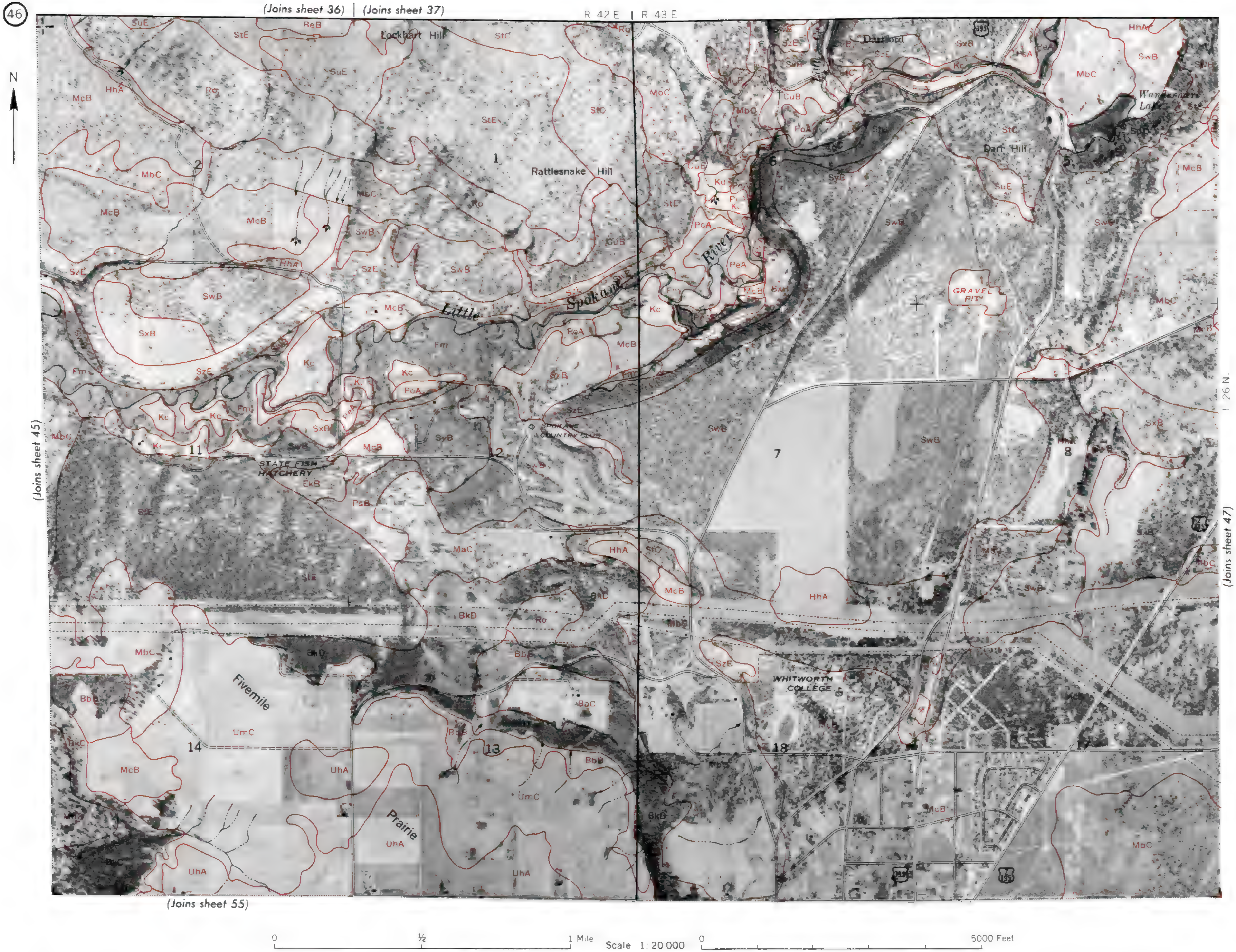


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

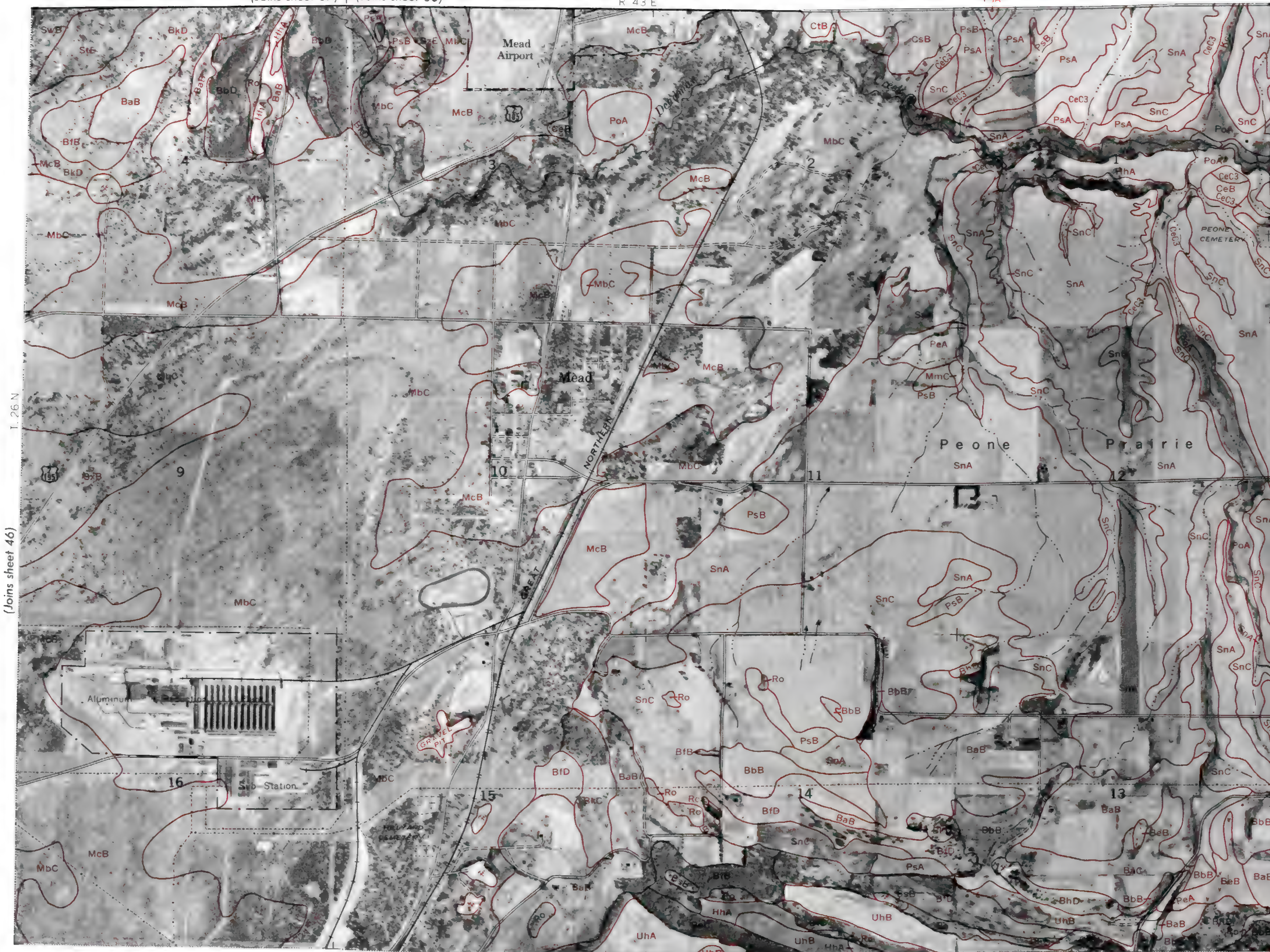
Range, township, and section corners shown on this map are indefinite

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet


46
(Joins sheet 36)
(Joins sheet 37)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 55)
R 42 E
R 43 E
T 26 N
N
Lockhart Hill
Rattlesnake Hill
Dartford
Dart Hill
Wandermere Lake
Little Spokane River
GRAVEL PIT
SPOKANE COUNTRY CLUB
STATE FISH HATCHERY
WHITWORTH COLLEGE
Fivemile Prairie
1
2
6
7
8
11
12
13
14
18
SuE
StC
BeB
StE
McB
HhA
Ro
MbC
SwB
SzE
SxB
Kc
Fm
PoA
CuB
MaC
HhA
BkD
BbB
BaC
UmC
UhA
PsB
EkB
BkC
Scale 1:20 000
0
½
1 Mile
0
5000 Feet

(Joins sheet 37) | (Joins sheet 38)

47



(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 56)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

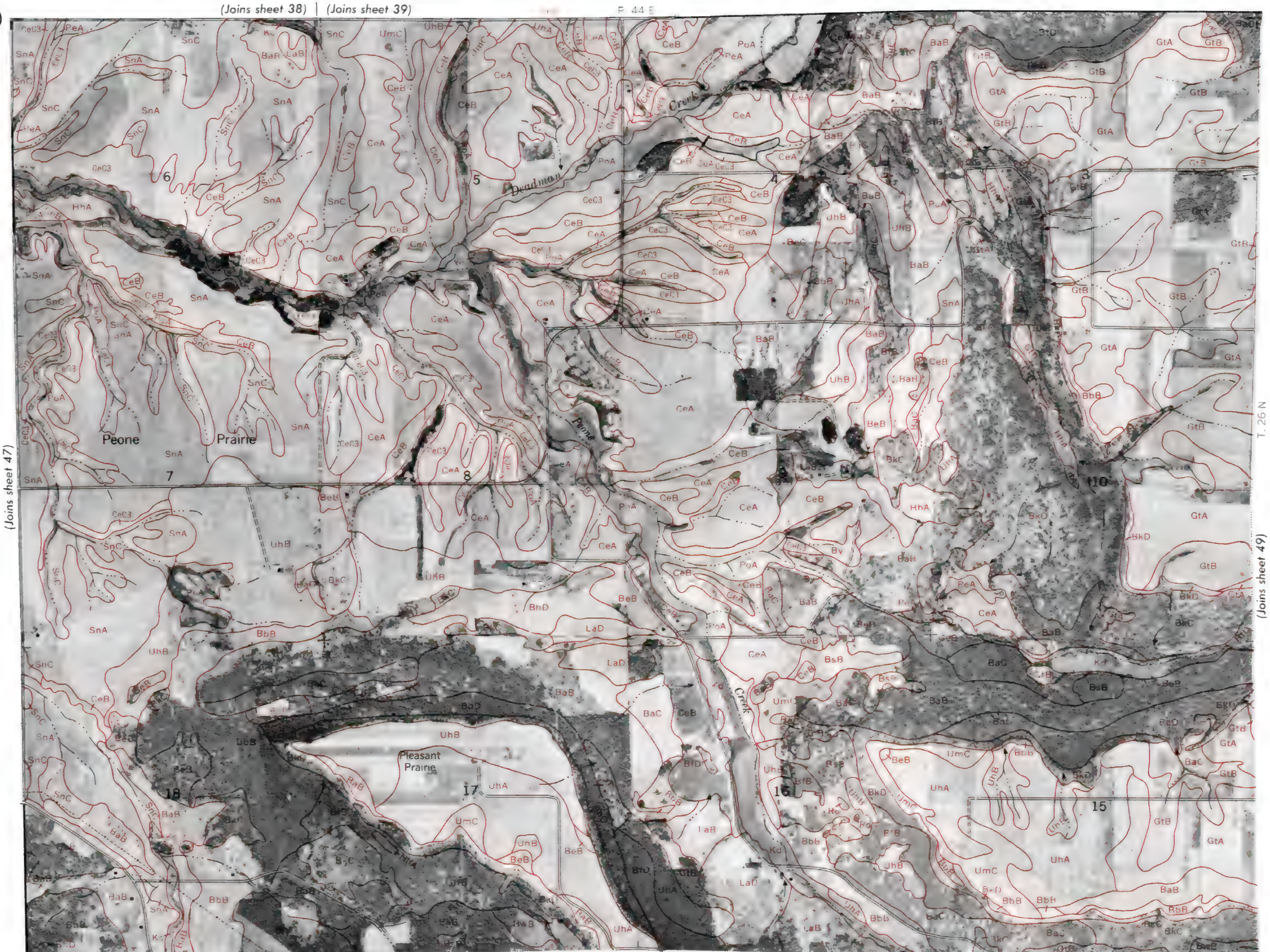
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

48

(Joins sheet 38) | (Joins sheet 39)

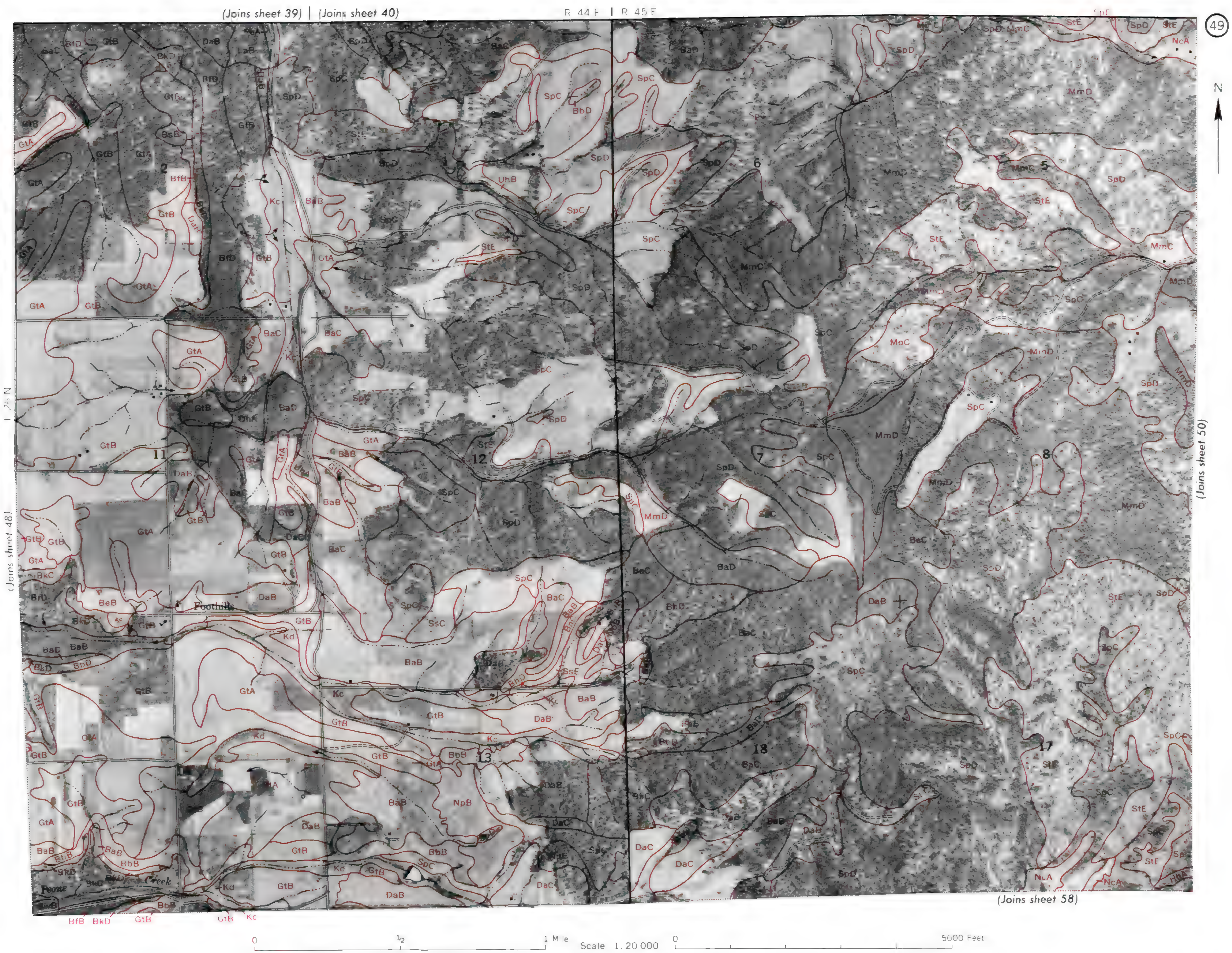
(Joins sheet 47)



(Joins sheet 49)

(Joins sheet 57)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

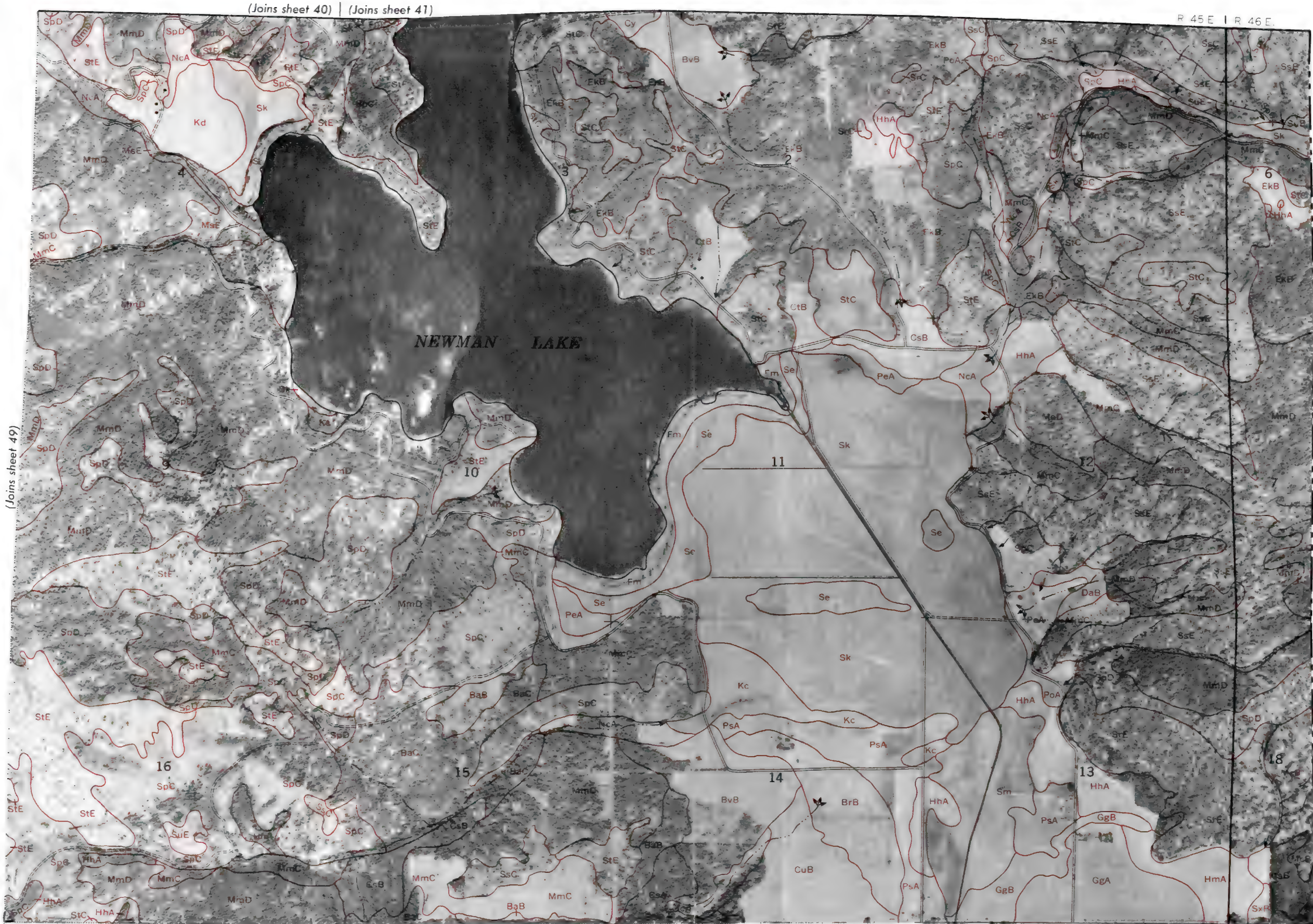


This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

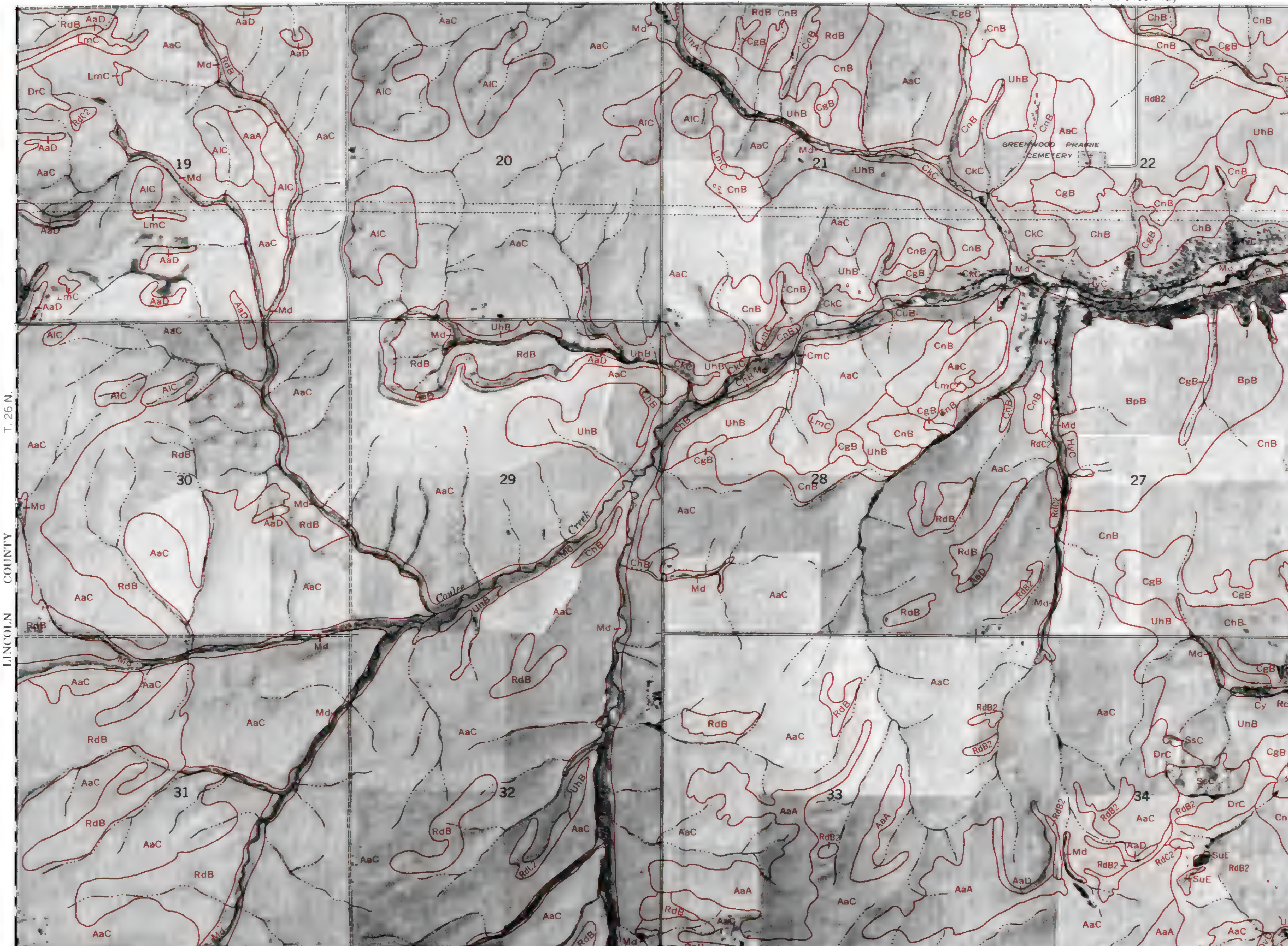
50

(Joins sheet 40) | (Joins sheet 41)



(Joins sheet 59)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



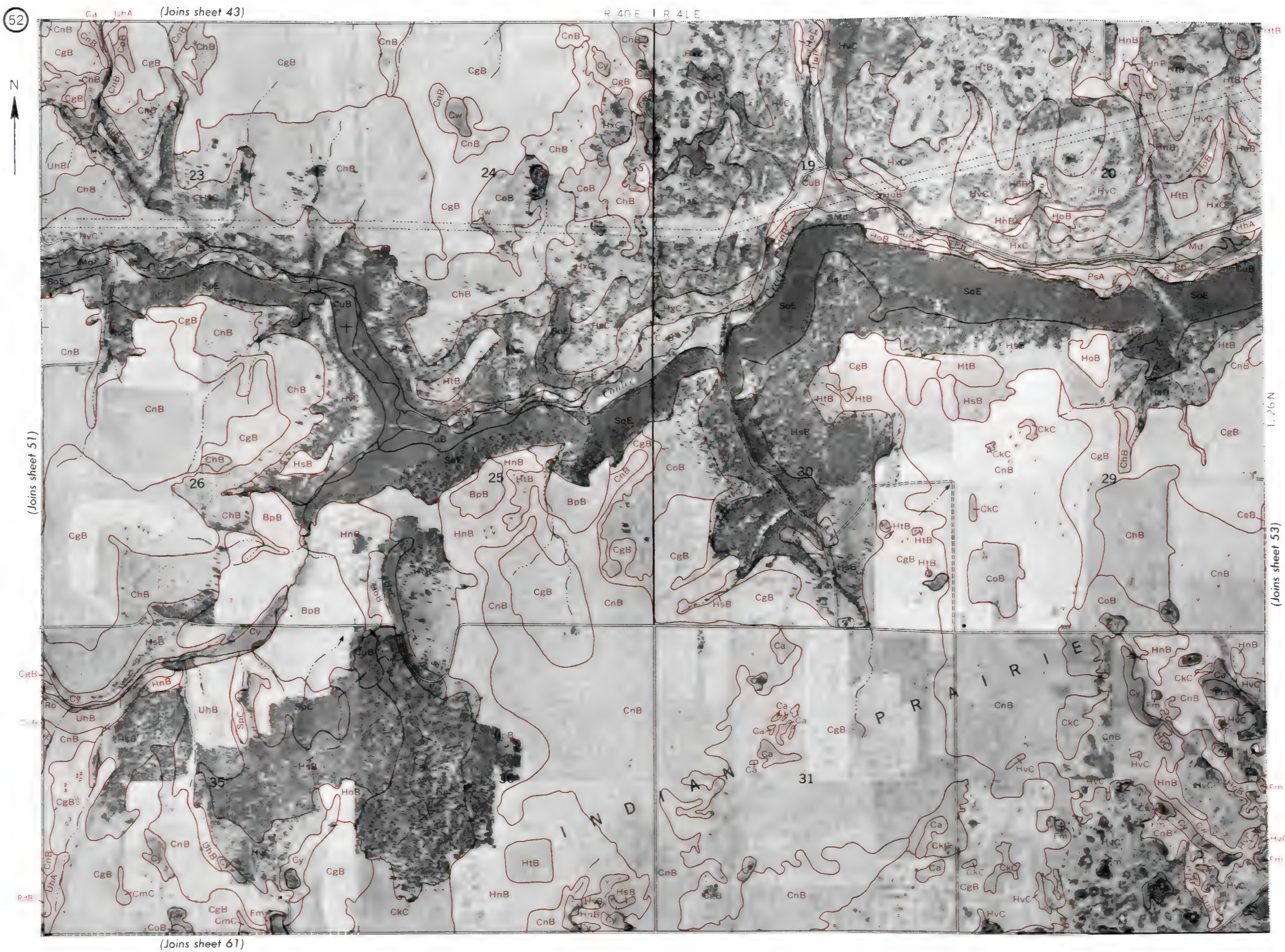
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

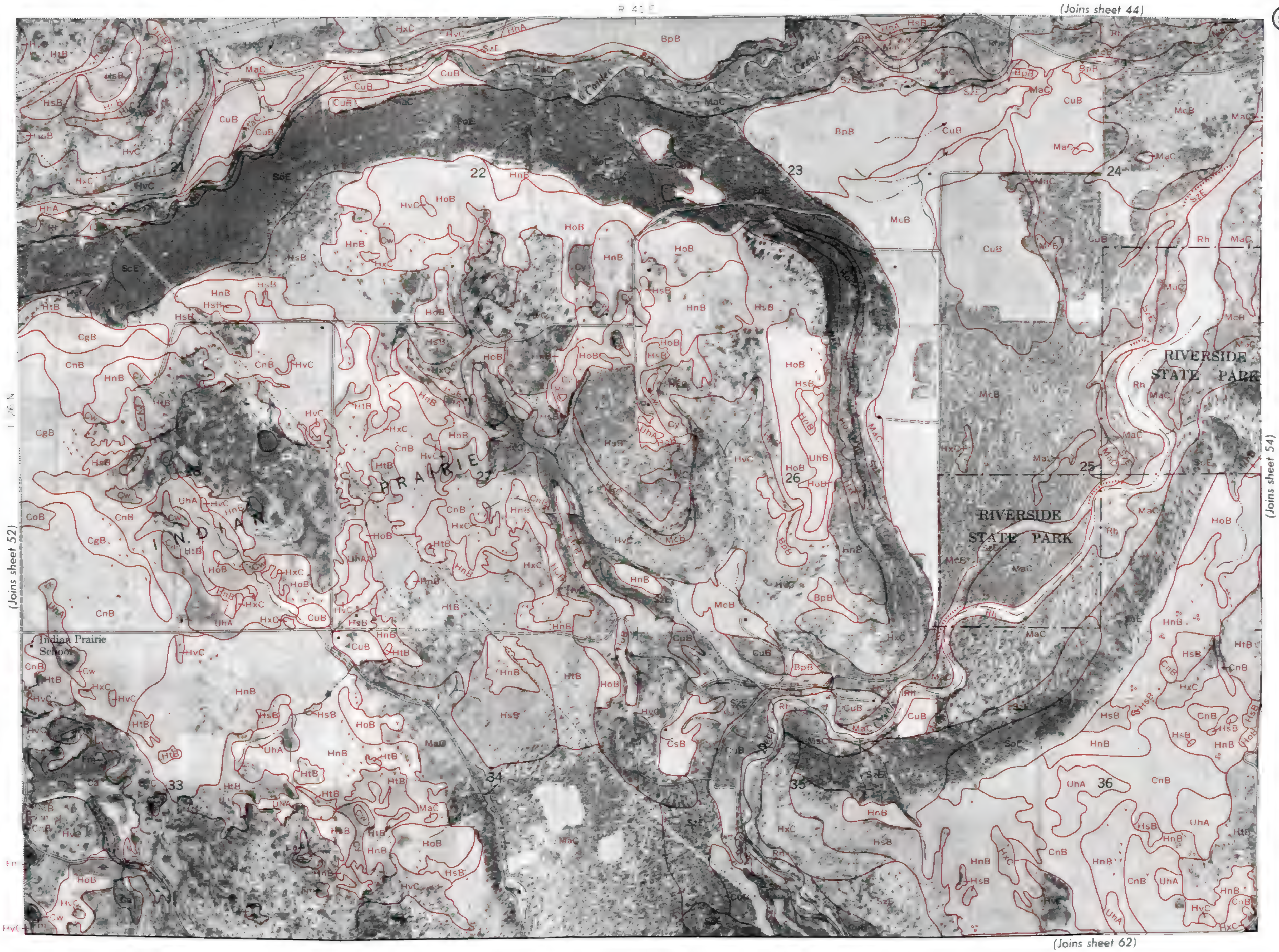
Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet



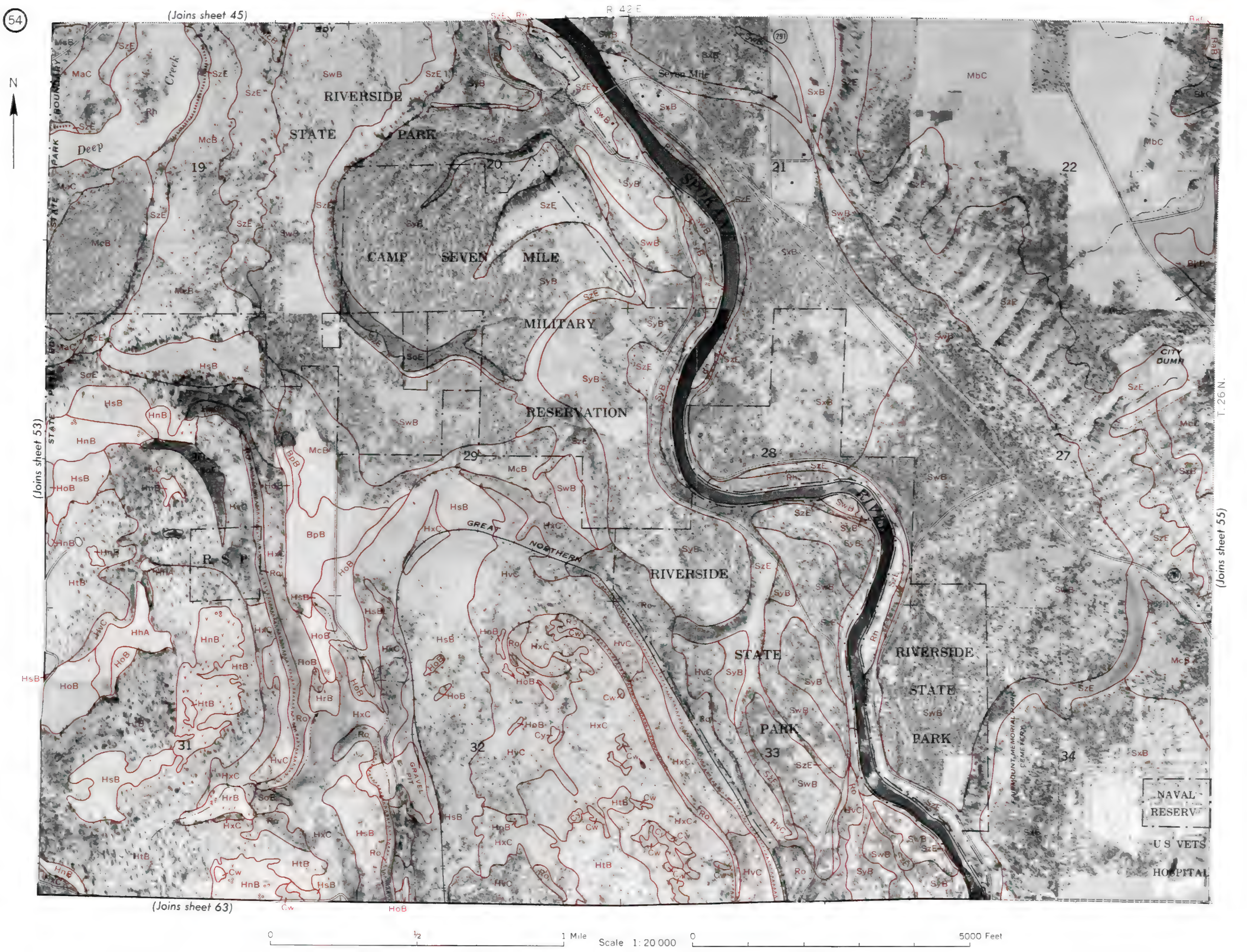
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



Scale 1:20 000
0 ½ 1 Mile
0 5000 Feet

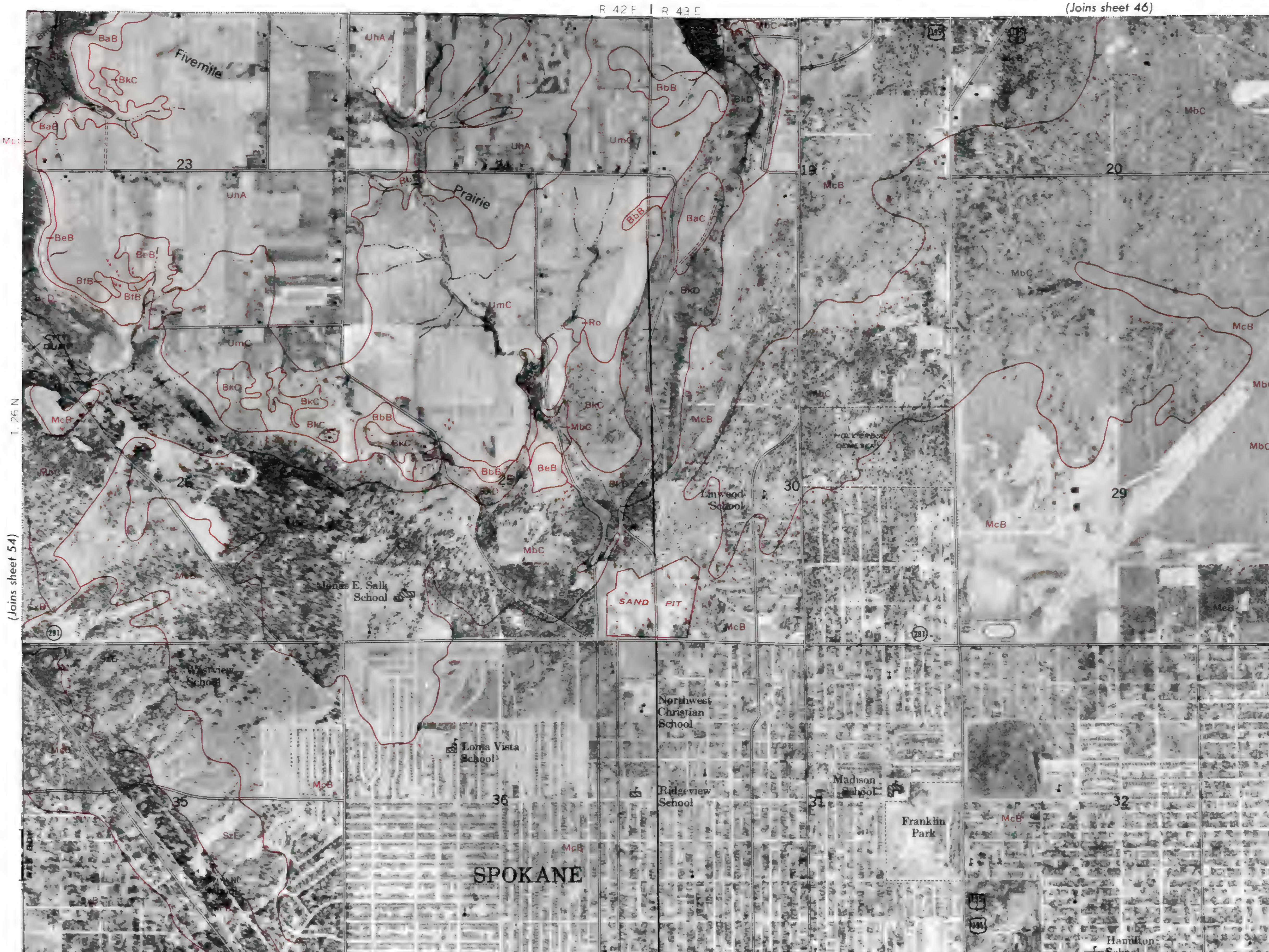
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


54
(Joins sheet 45)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 63)
R 42 E
T. 26 N.
N
RIVERSIDE STATE PARK
CAMP SEVEN MILE MILITARY RESERVATION
RIVERSIDE STATE PARK
RIVERSIDE STATE PARK
SPOKANE RIVER
GREAT NORTHERN
Deep Creek
Seven Mile
CITY DUMP
NAVAL RESERV
U S VETS HOSPITAL
19
20
21
22
27
28
29
31
32
33
34
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

55

(Joins sheet 46)



(Joins sheet 54)

(Joins sheet 56)

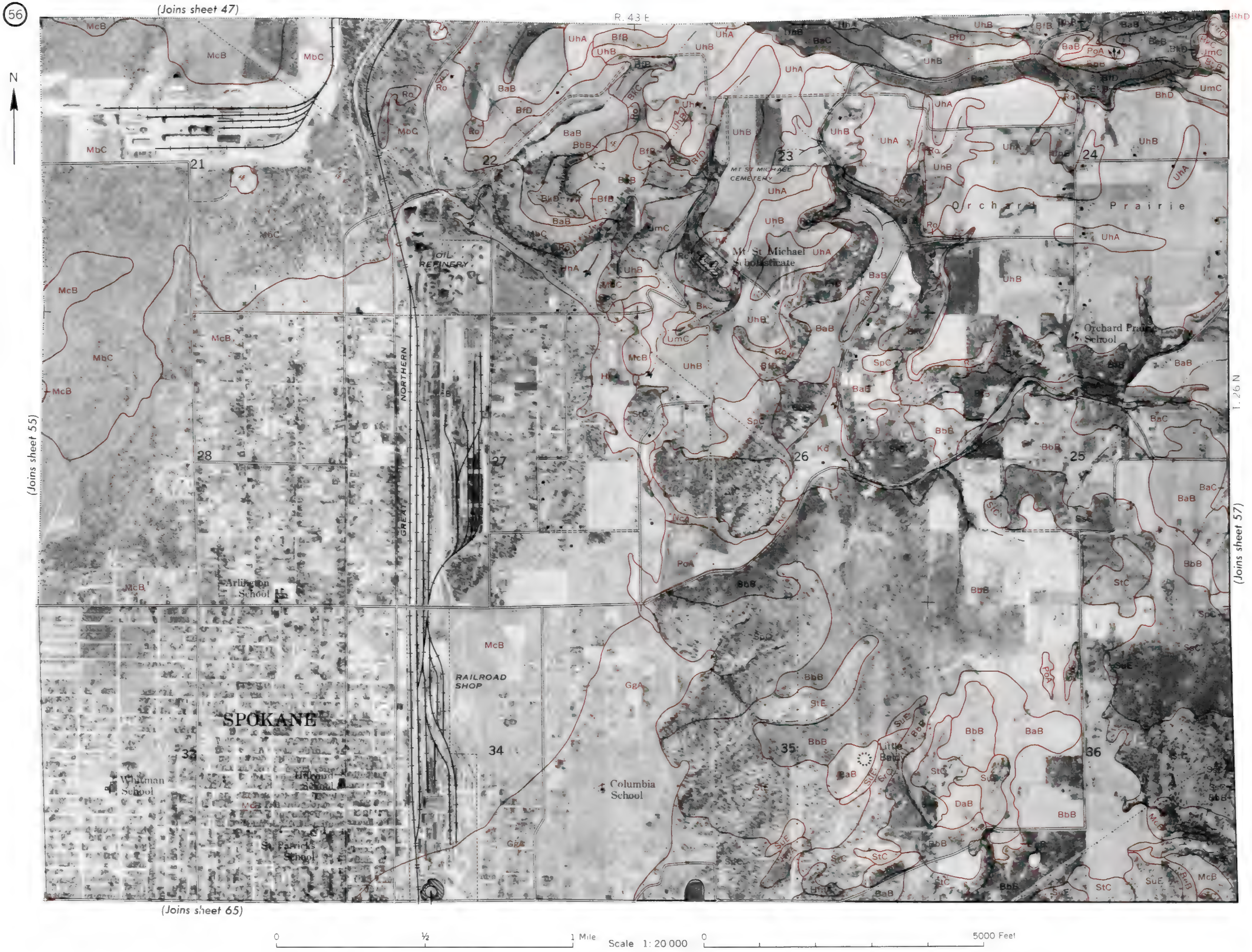
(Joins sheet 64)

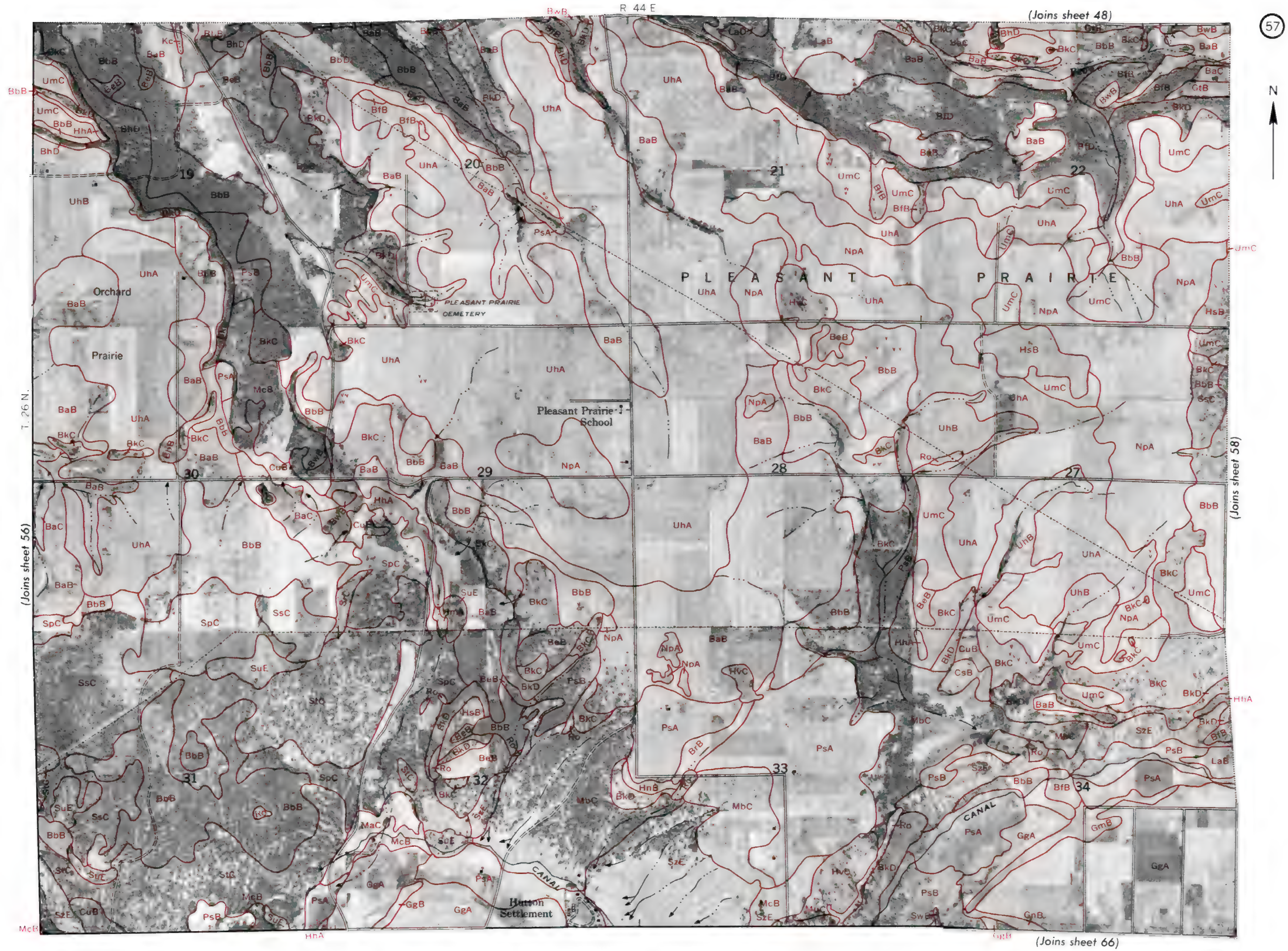
N

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite.

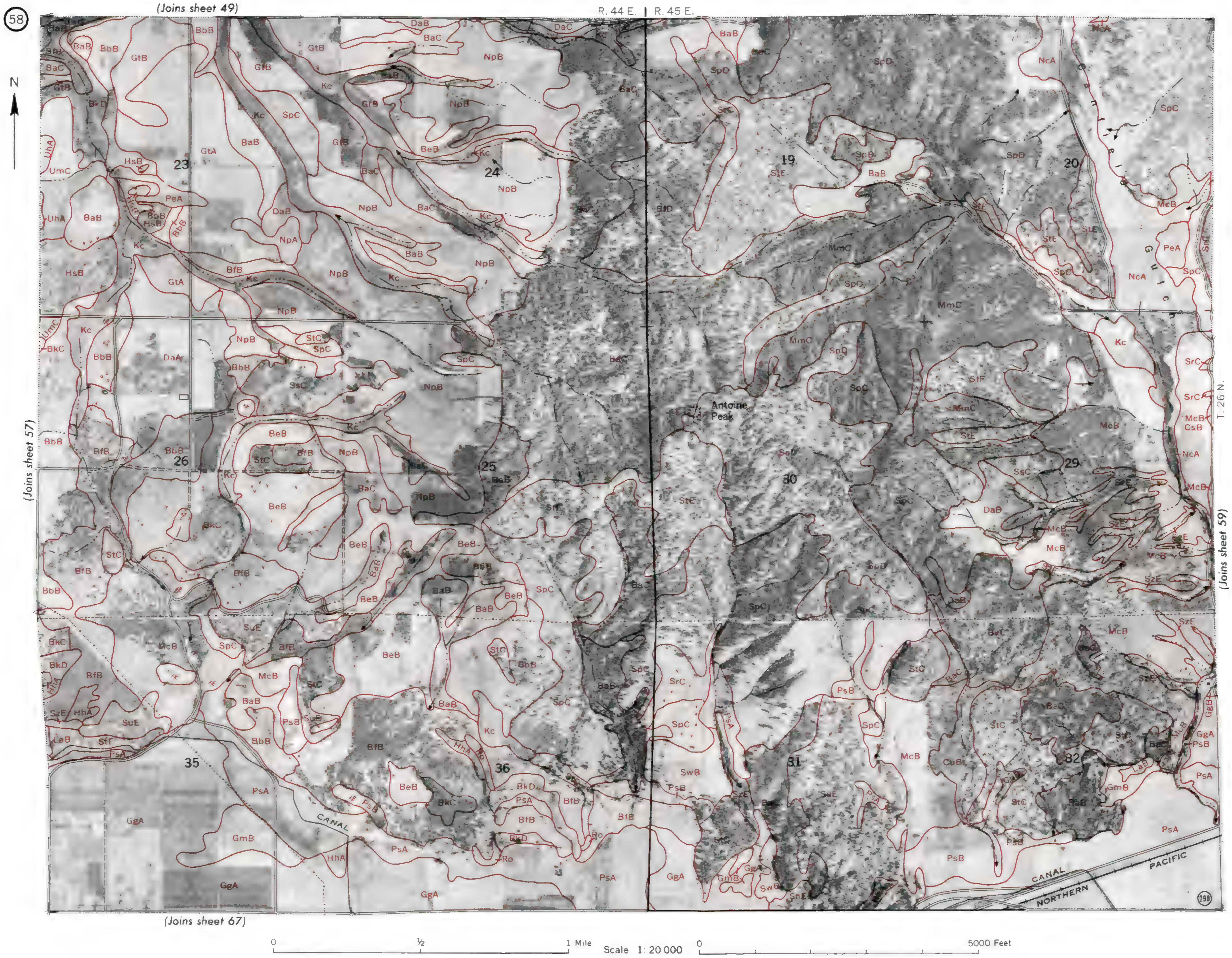

56
(Joins sheet 47)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 65)
R. 43 E.
T. 26 N.
N
SPOKANE
Arlington School
Whitman School
Hamond School
St. Patricks School
Columbia School
Orchard Prairie
Orchard Prairie School
Mt St Michael Scholasticate
MT ST MICHAEL CEMETERY
OIL REFINERY
RAILROAD SHOP
GREAT NORTHERN
Little Baldy
21
22
23
24
28
27
26
25
33
34
35
36
McB
MbC
UhA
UhB
BfB
BfD
BaB
BbB
BaC
BhD
BkC
UmC
Ro
PoA
SpC
StC
StE
SuE
DaB
GgA
Kd
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


58
(Joins sheet 49)
R. 44 E.
R. 45 E.
(Joins sheet 57)
(Joins sheet 59)
T. 26 N.
(Joins sheet 67)
Antoine Peak
23
24
19
20
26
25
30
29
35
36
31
32
CANAL
NORTHERN PACIFIC
Gulch
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

(Joins sheet 50)

R 45 E | R 46 E

59

(Joins sheet 58)

(Joins sheet 68)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

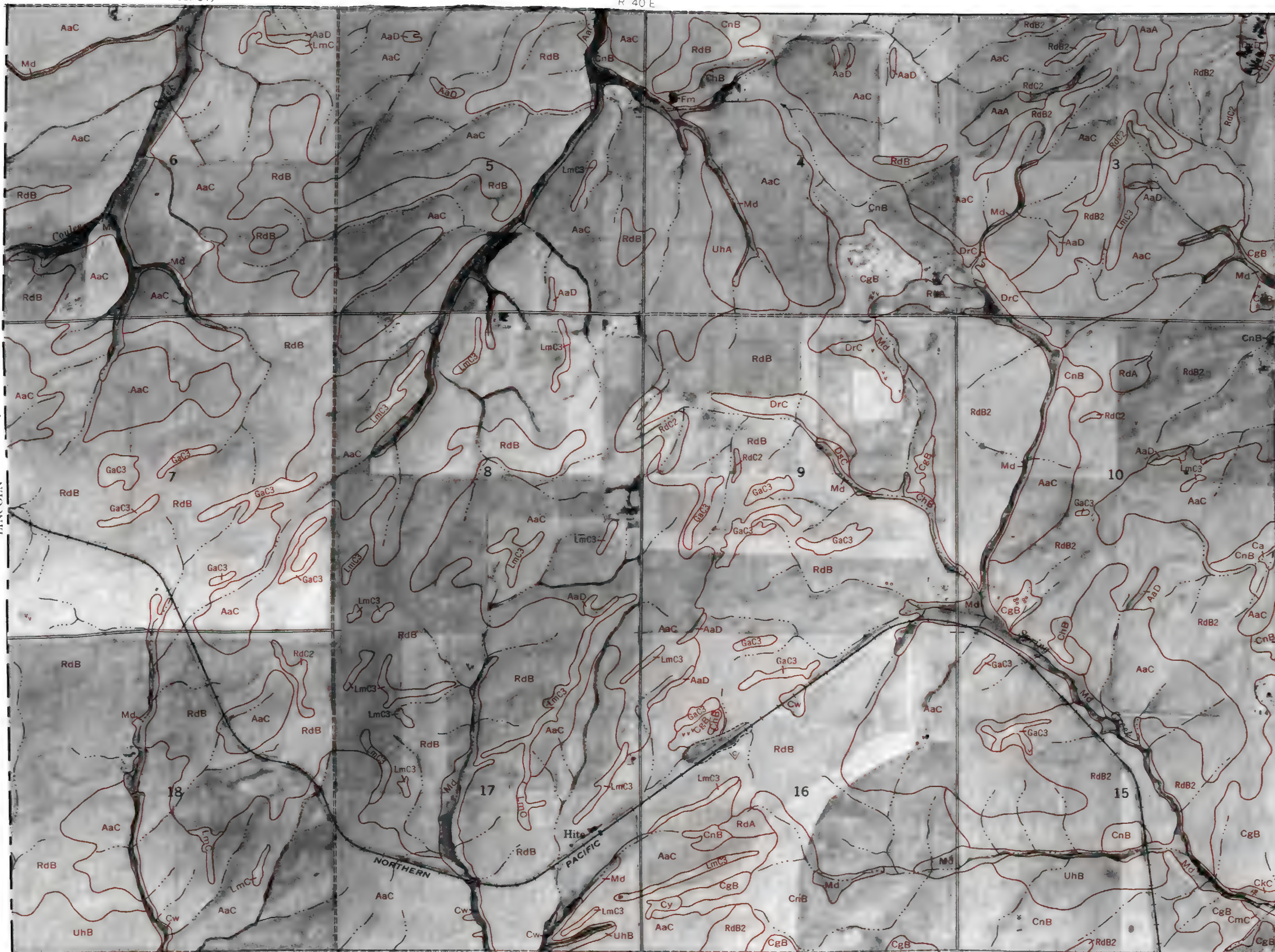
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

60

(Joins sheet 51)

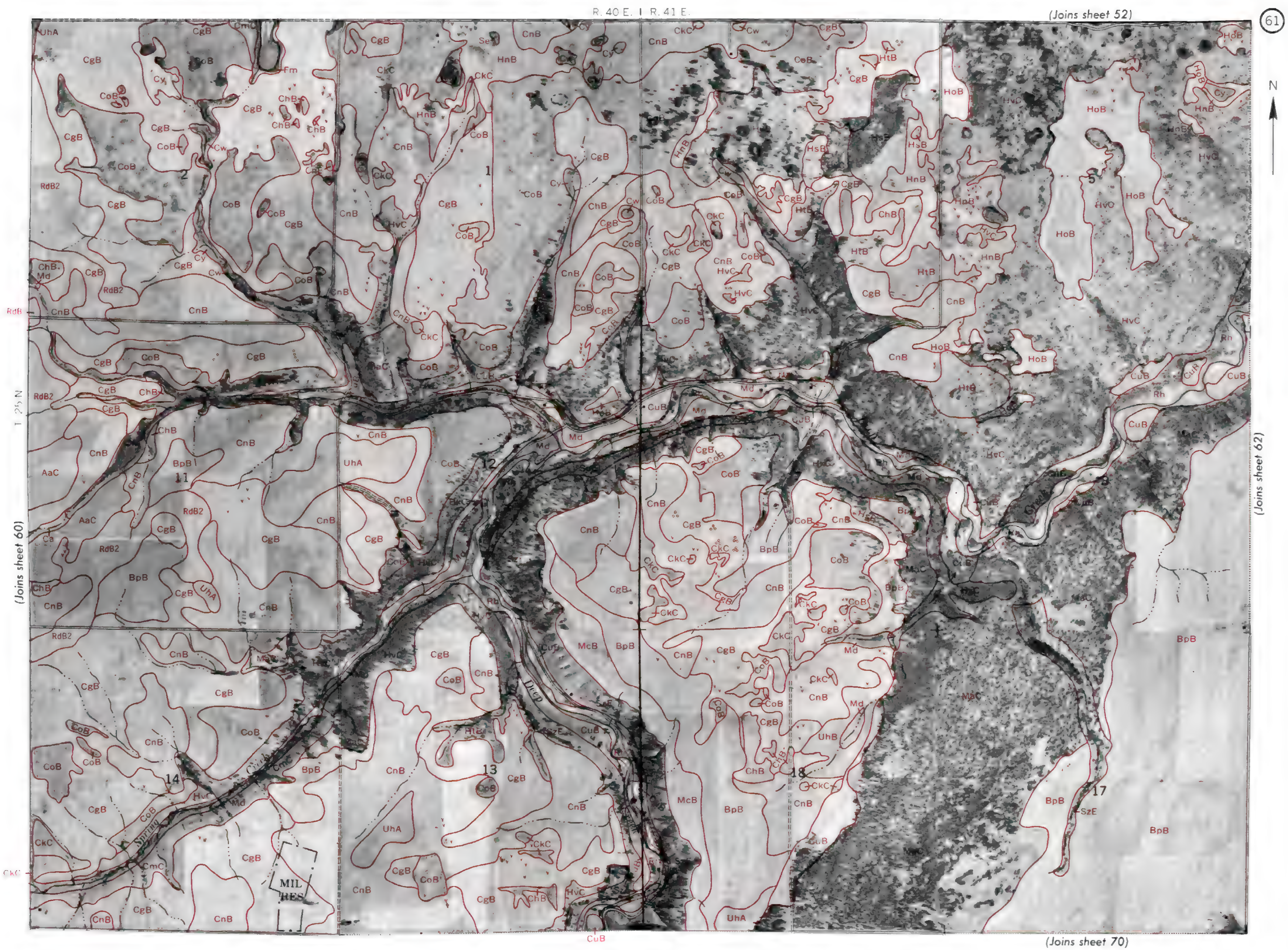
R 40 E



(Joins sheet 61)

(Joins sheet 69)

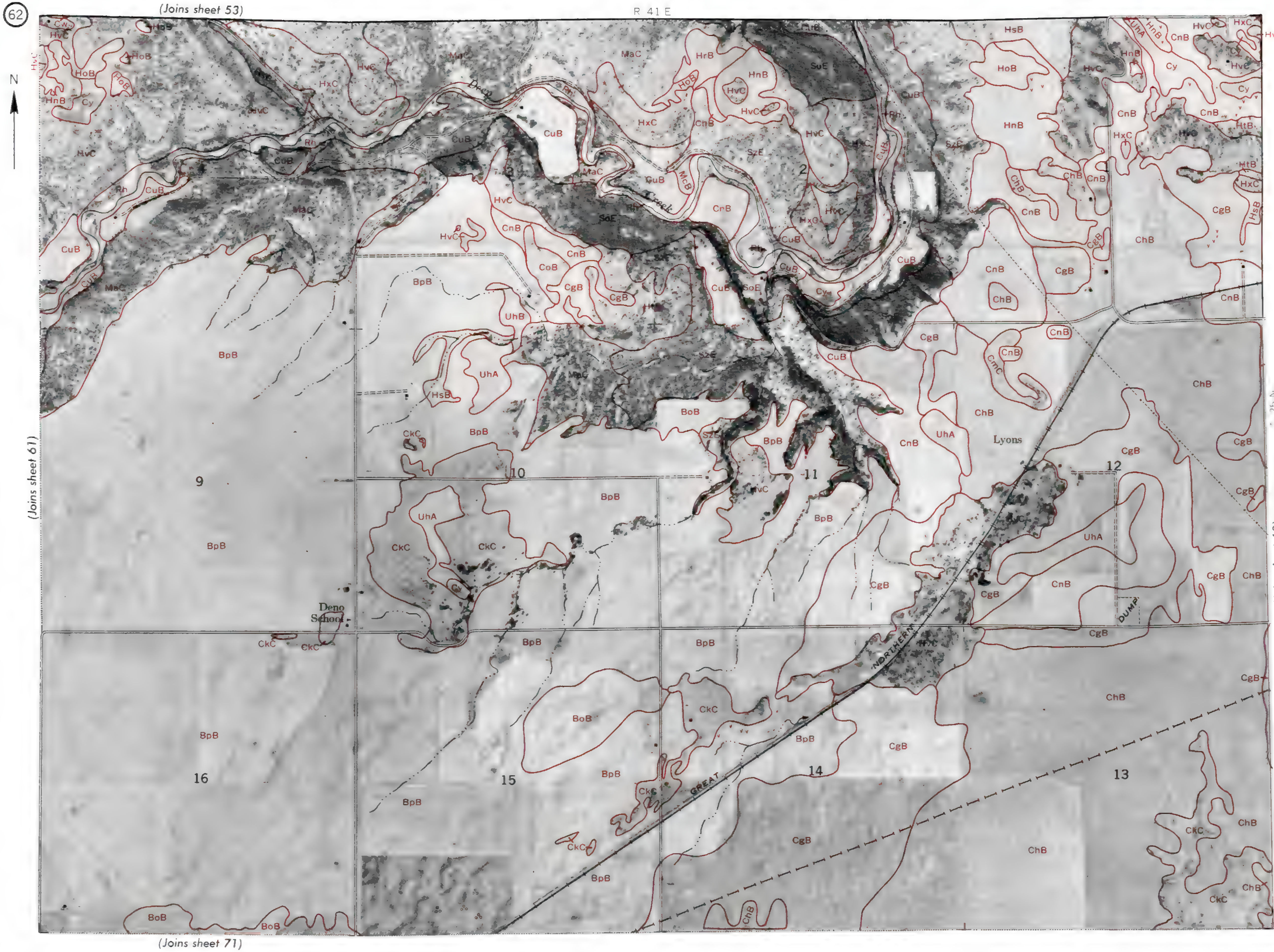
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

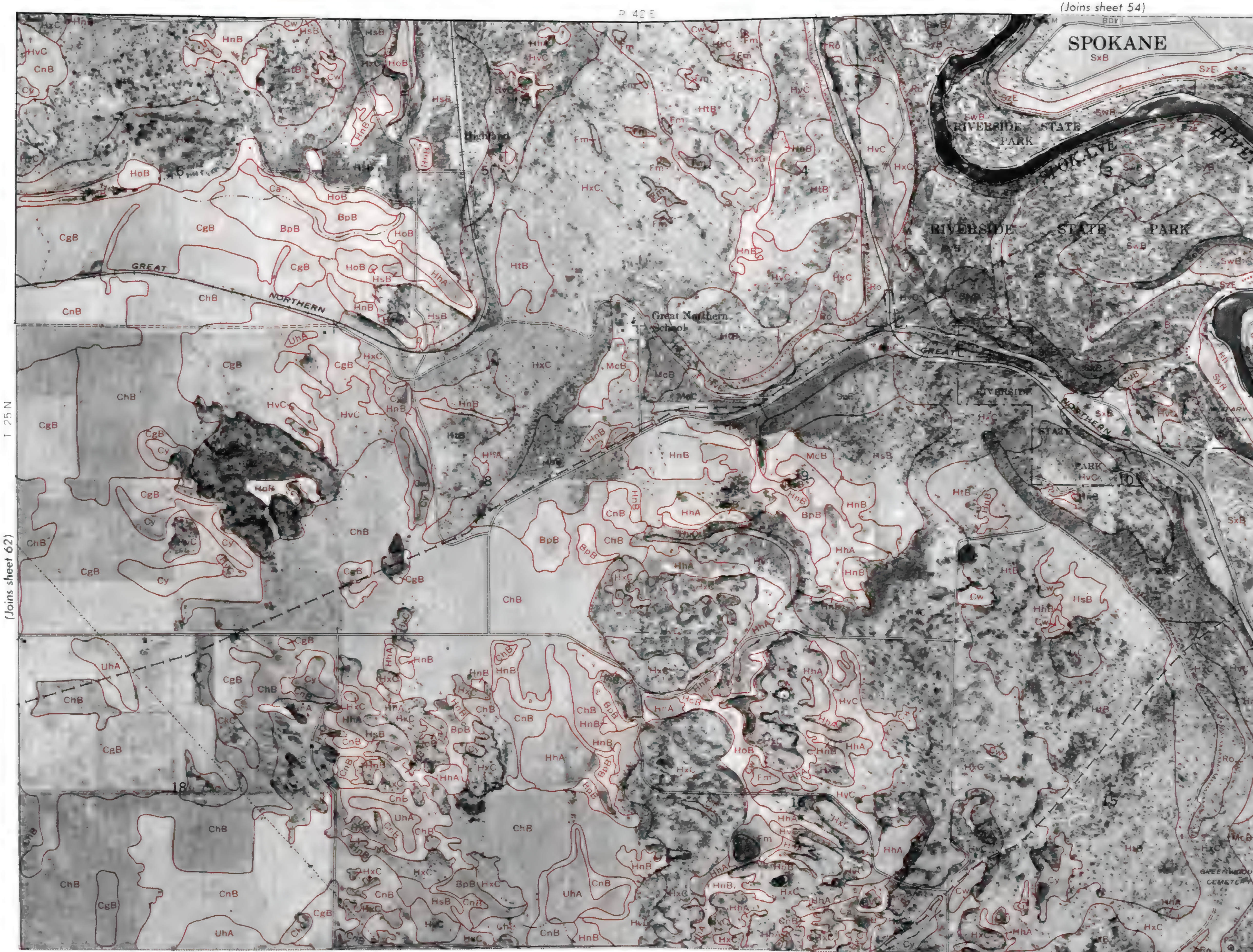
Range, township, and section corners shown on this map are indefinite



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 54)

63



(Joins sheet 62)

(Joins sheet 64)

(Joins sheet 72)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

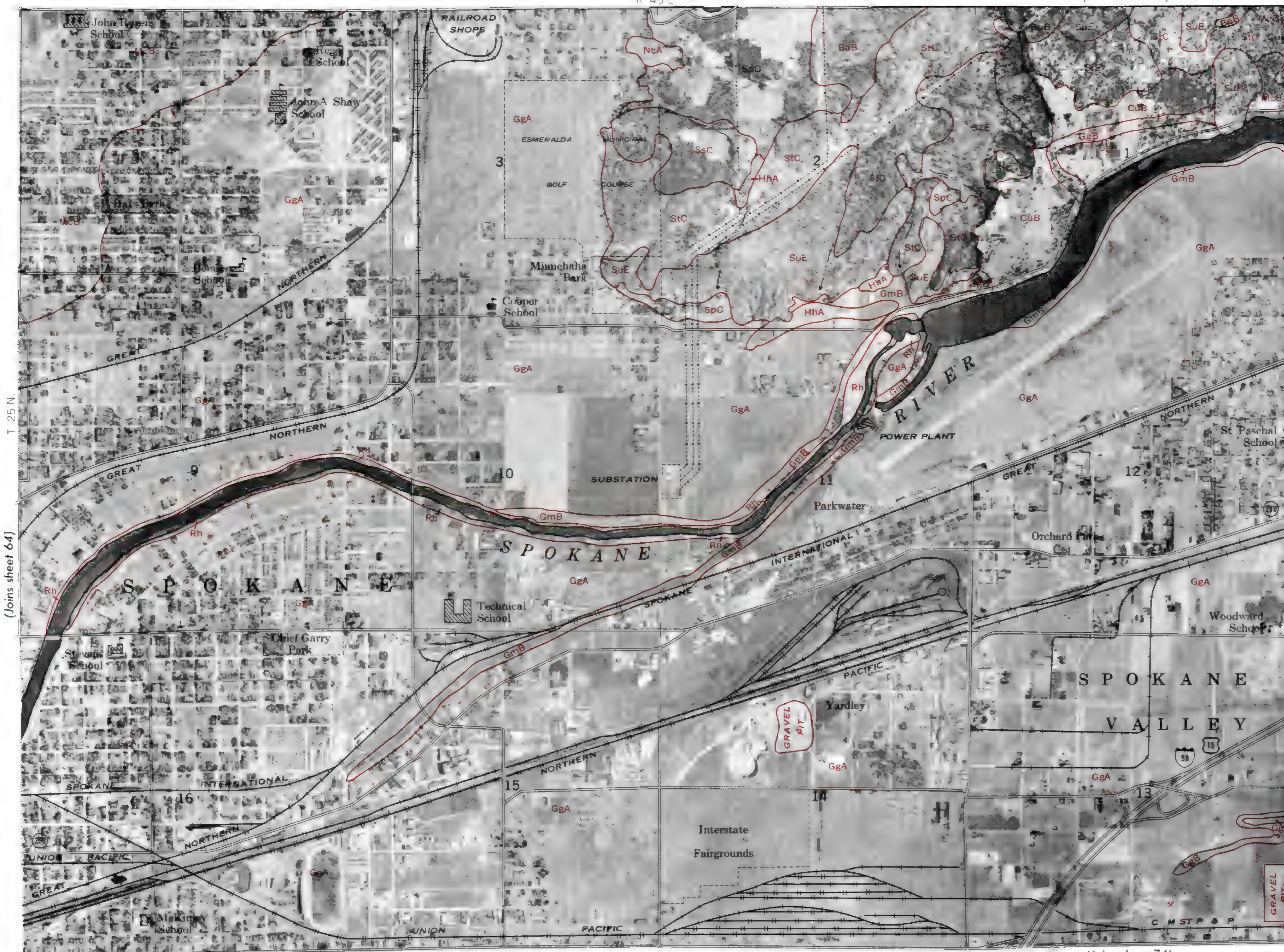
Range, township, and section corners shown on this map are indefinite

64

(Joins sheet 55)

(Joins sheet 73)

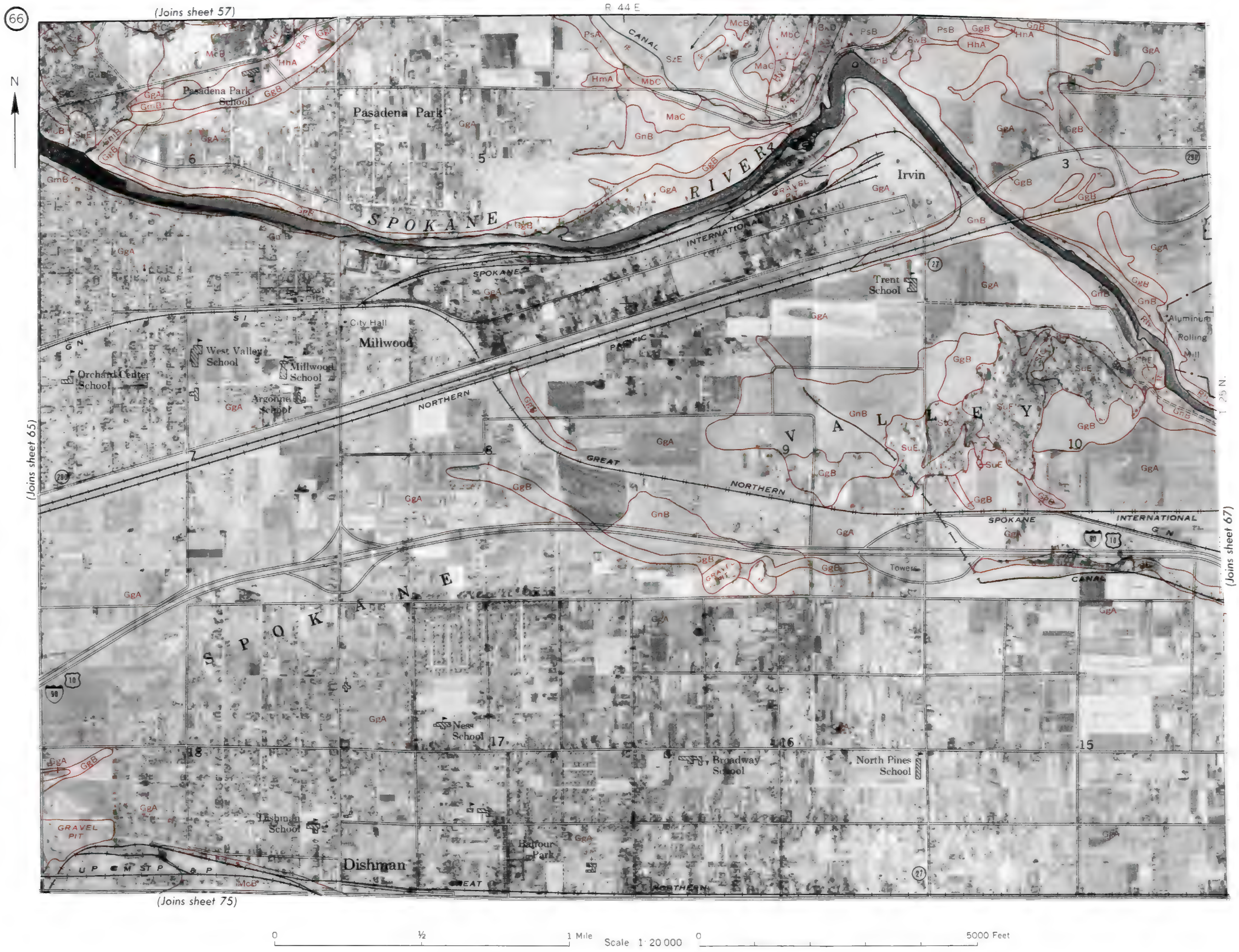
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



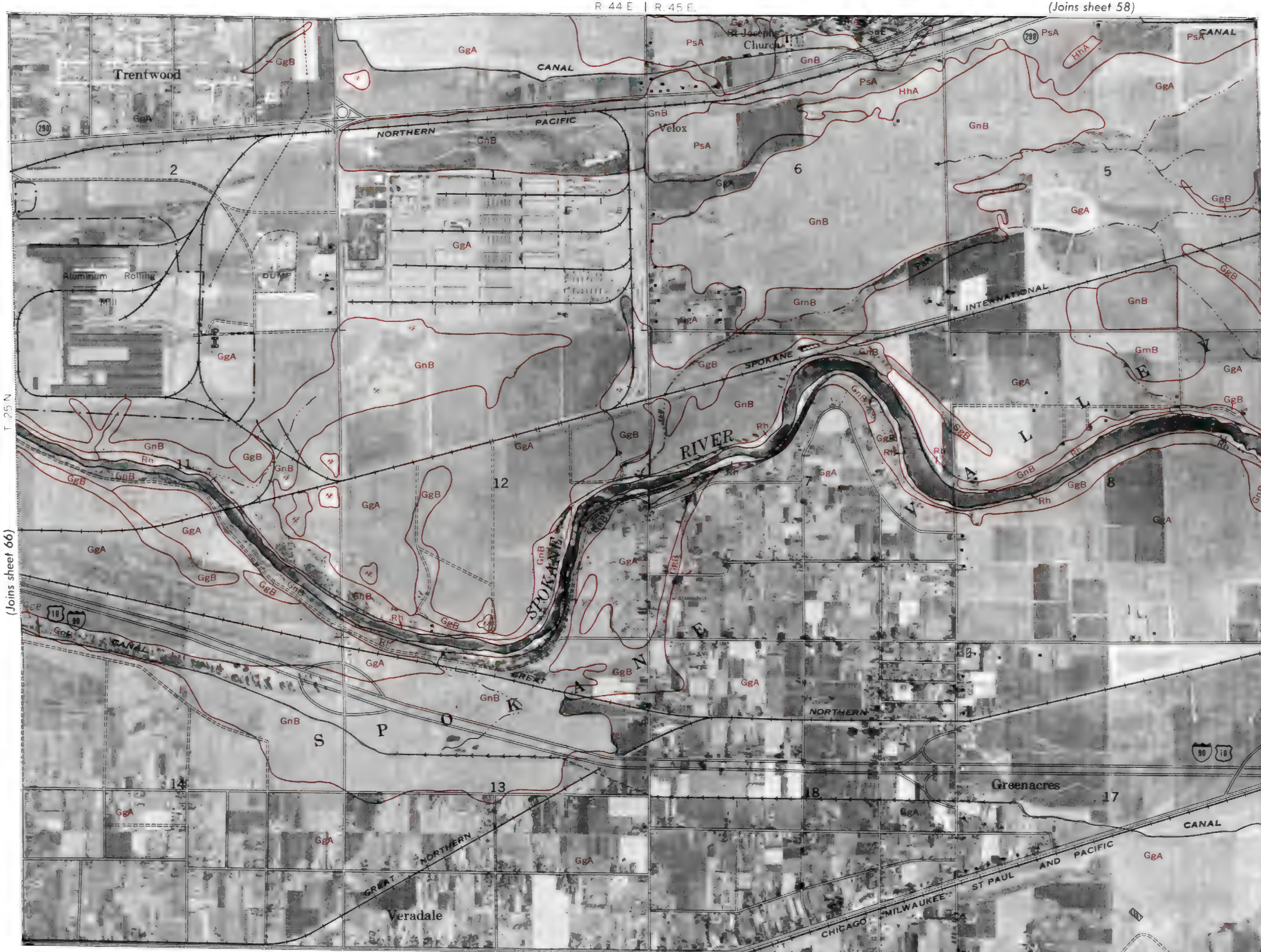
Scale 1:20 000
0 ½ 1 Mile
0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


66
(Joins sheet 57)
R 44 E
N
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 75)
T 25 N.
SPOKANE RIVER
SPOKANE VALLEY
Pasadena Park
Pasadena Park School
Irvin
Millwood
City Hall
West Valley School
Millwood School
Orchard Center School
Argonne School
Trent School
Aluminum Rolling Mill
Ness School
Broadway School
North Pines School
Dishman School
Dishman
Balfour Park
Tower
CANAL
GRAVEL PIT
SPOKANE INTERNATIONAL
NORTHERN PACIFIC
GREAT NORTHERN
U P
C M ST P & P
Scale 1:20 000
0
½
1 Mile
5000 Feet

(Joins sheet 58)



(Joins sheet 66)

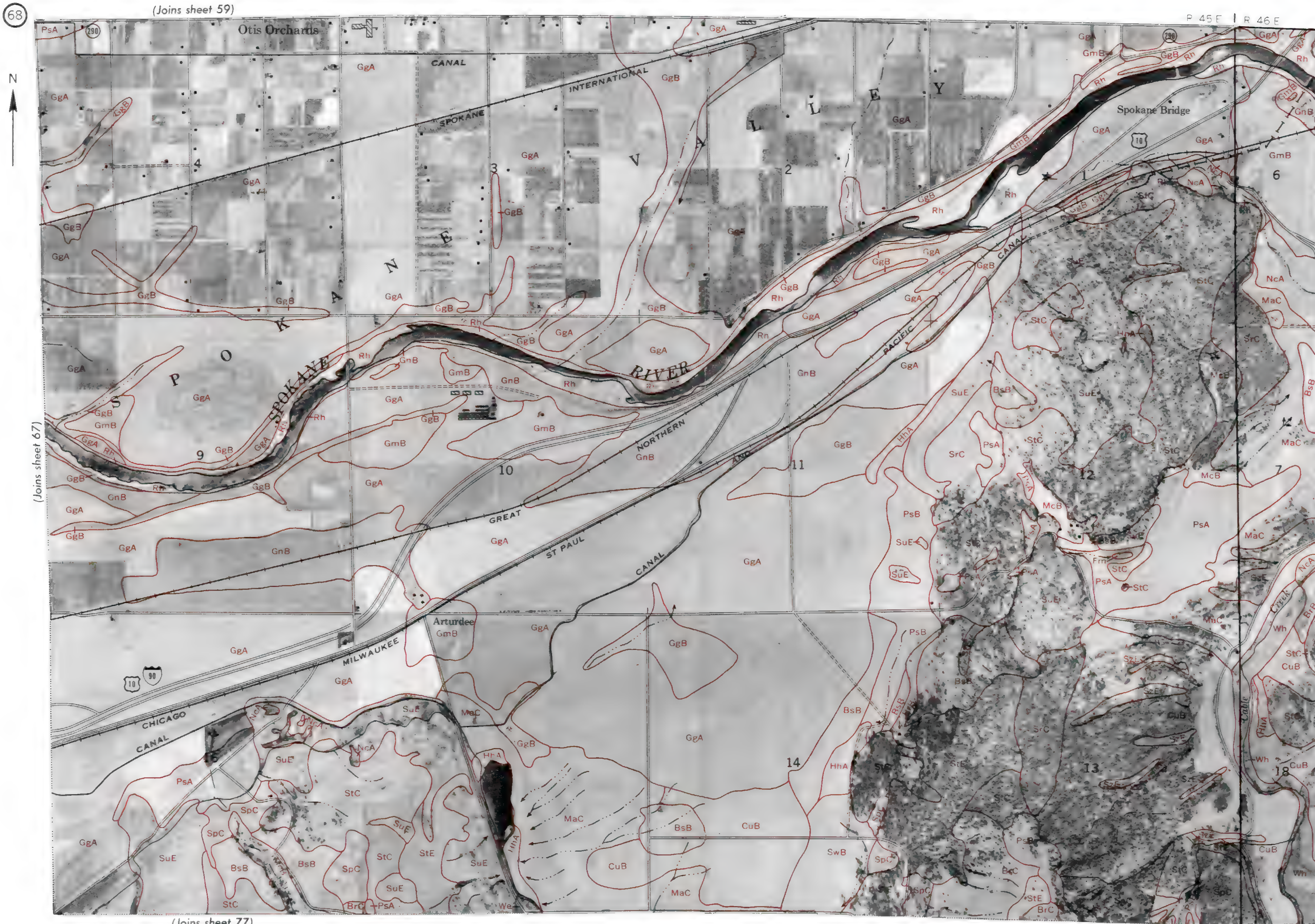
(Joins sheet 68)

(Joins sheet 76)

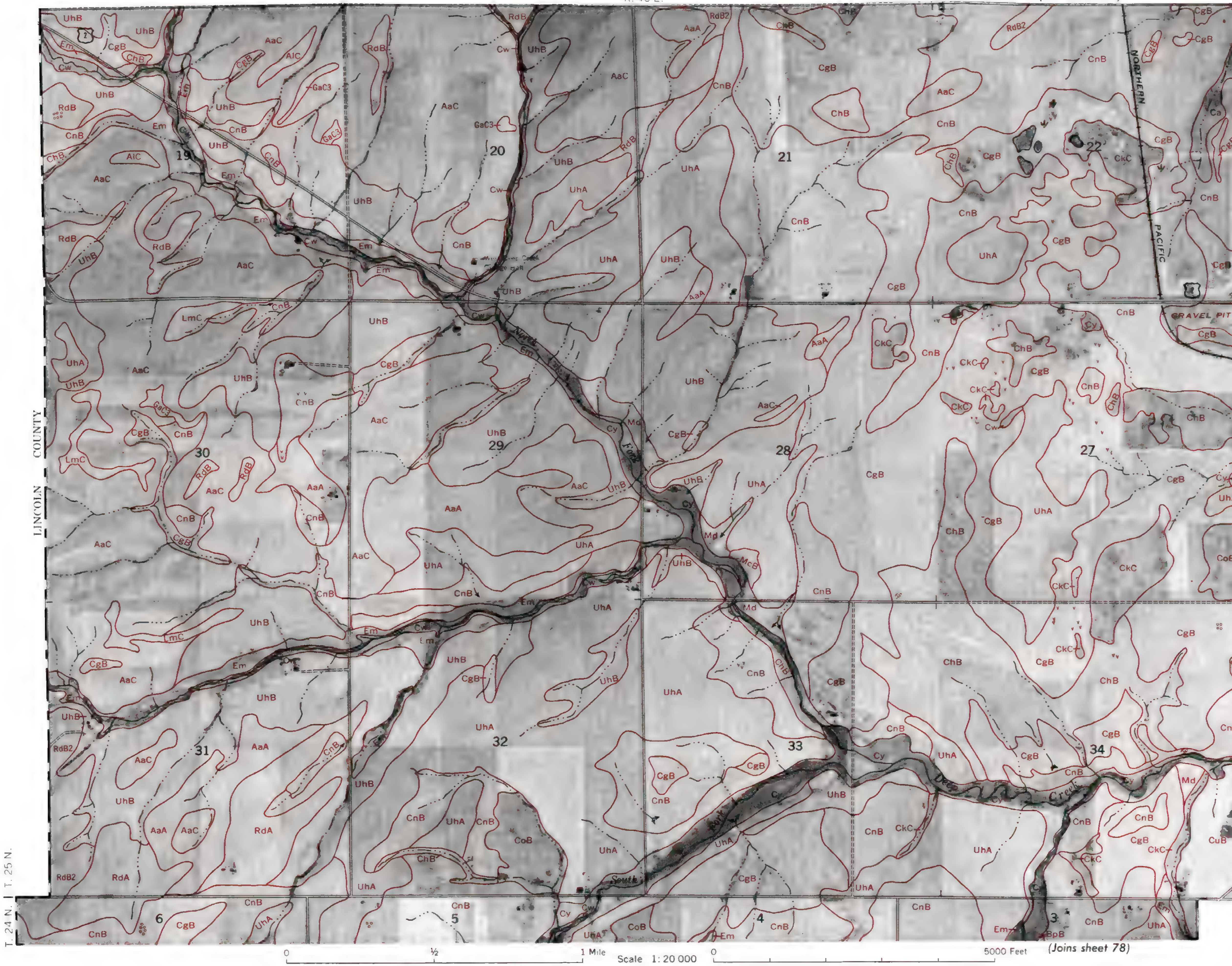
Scale 1:20 000
0 ½ 1 Mile
0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

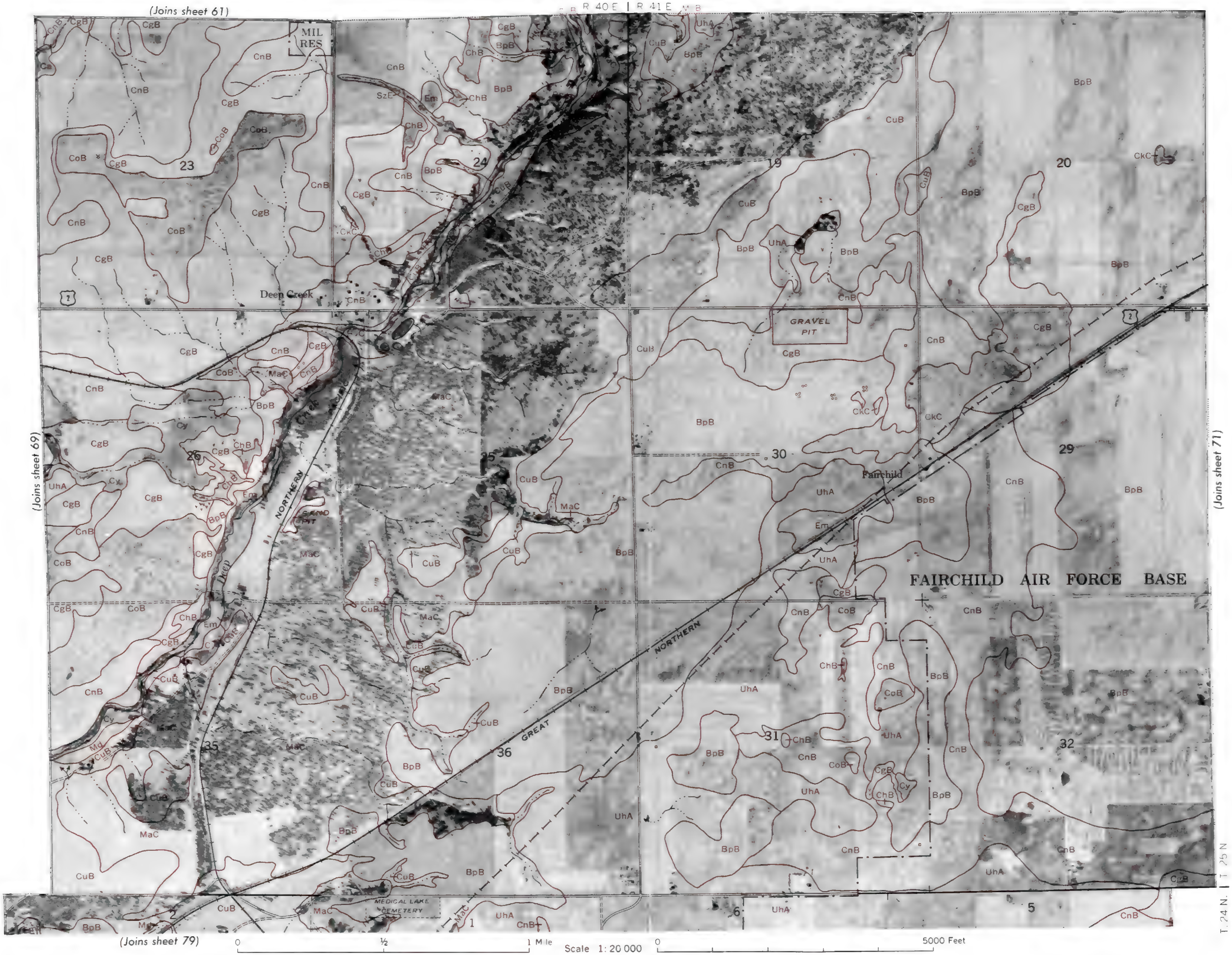


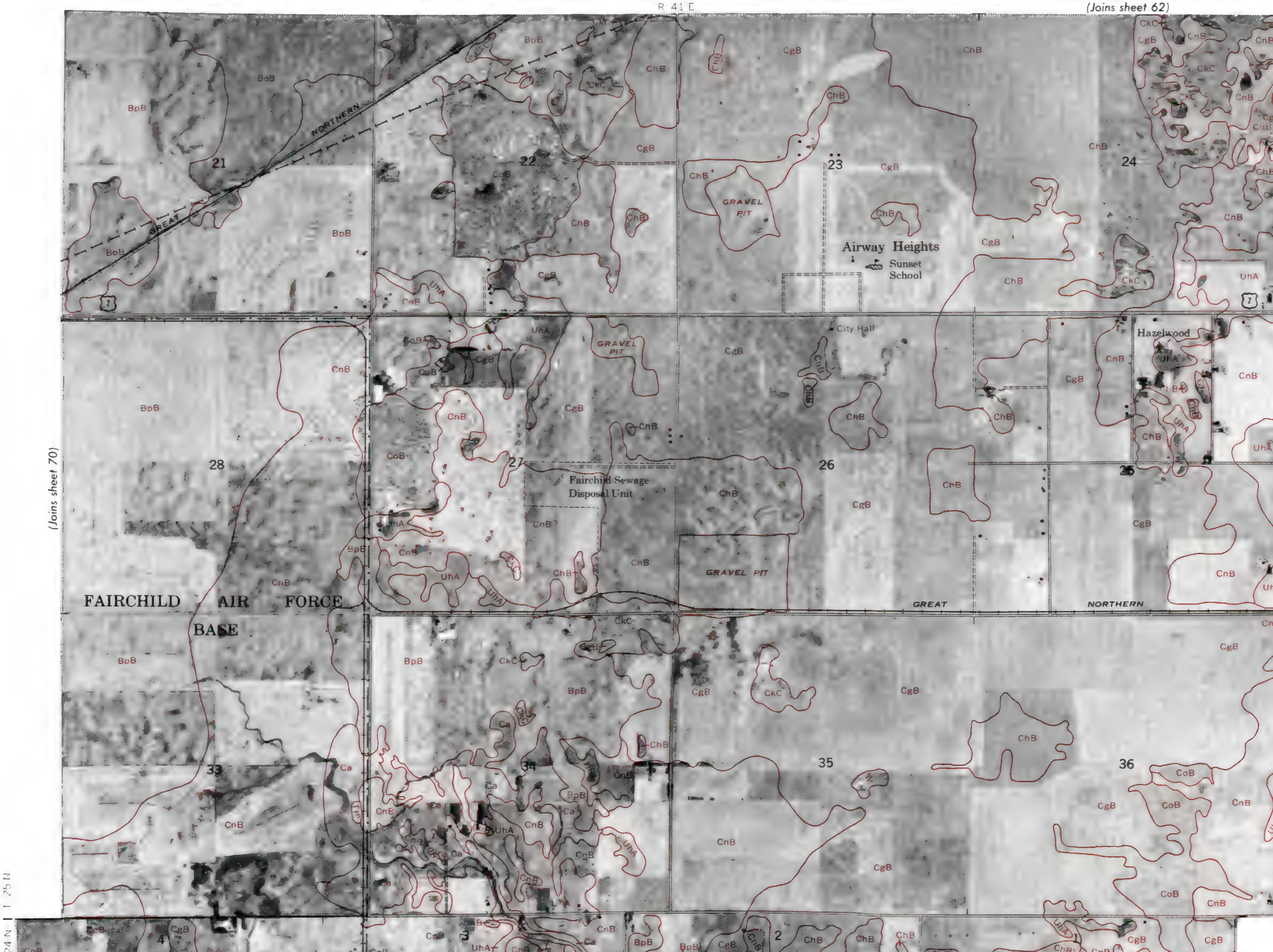
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


70
(Joins sheet 61)
R 40 E | R 41 E
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 79)
MIL RES
Deep Creek
GRAVEL PIT
SAND PIT
Fairchild
FAIRCHILD AIR FORCE BASE
GREAT NORTHERN
MEDICAL LAKE CEMETERY
T. 24 N. | T. 25 N.
23
24
19
20
26
25
30
29
35
36
31
32
2
1
6
5
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet



Scale 1:20 000
0 ½ 1 Mile
0 5000 Feet

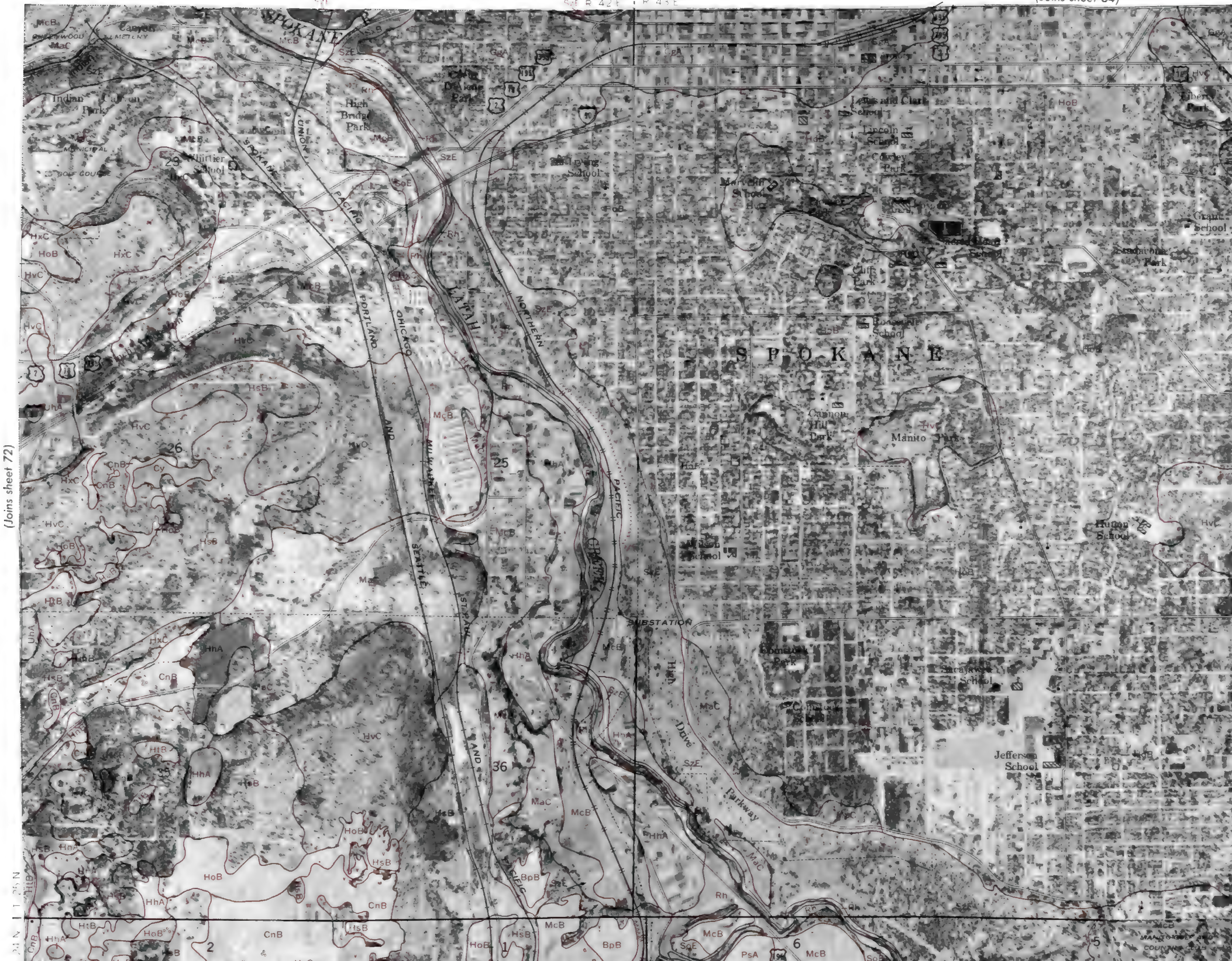
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


72
(Joins sheet 63)
R 42 E
N
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 81)
5000 Feet
0
Scale 1:20 000
1 Mile
½
0
GEIGER FIELD
(SPOKANE MUNICIPAL AIRPORT)
GEIGER AIR FORCE BASE
GAFB
AIR NATIONAL GUARD AREA
GREAT NORTHERN
Indian Canyon
Garden Springs School
19
21
22
27
28
29
30
31
32
33
34

(Joins sheet 64)

73



(Joins sheet 72)

(Joins sheet 74)

(Joins sheet 82)

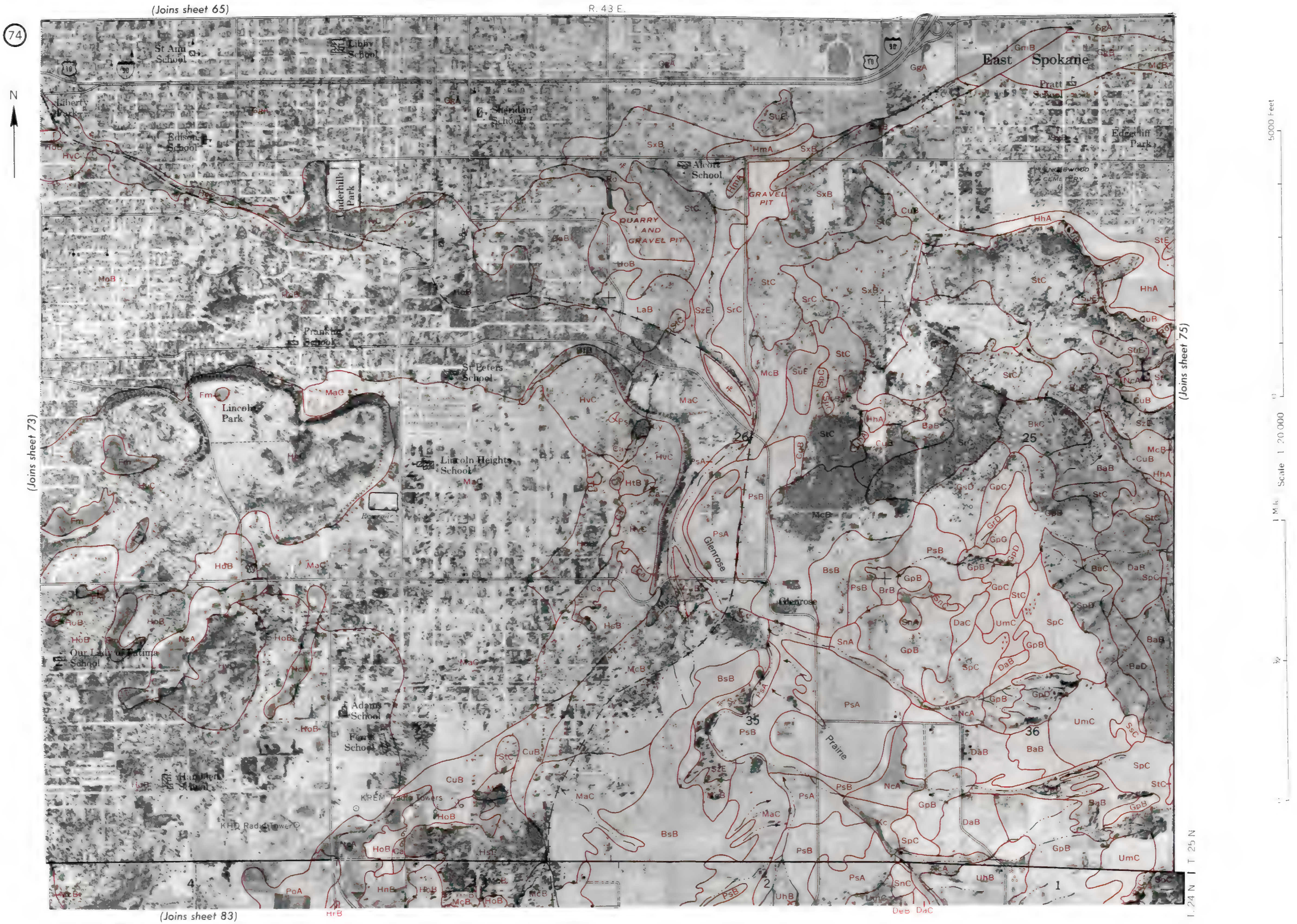
Scale 1:20 000

0 ½ 1 Mile

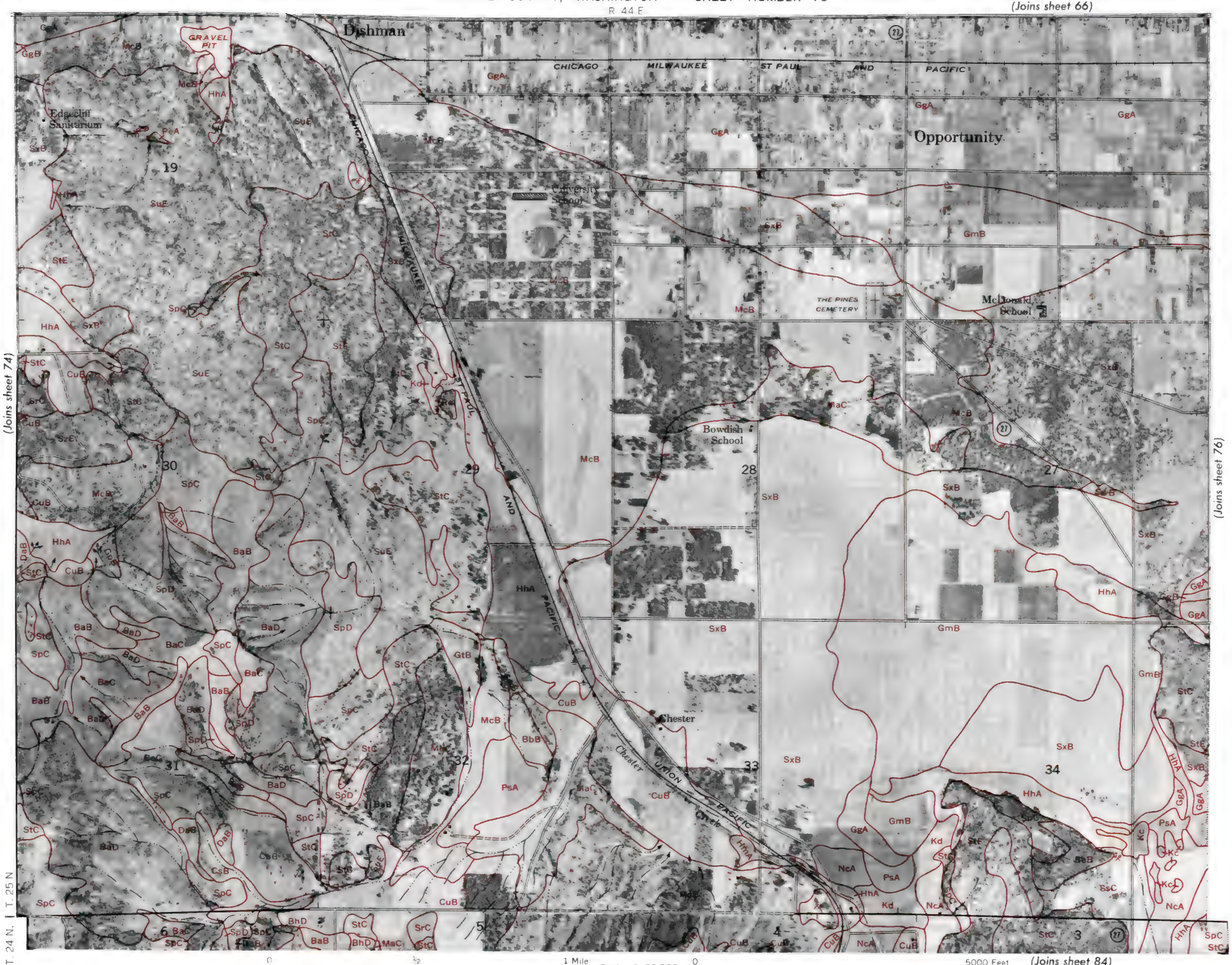
0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


(Joins sheet 65)
R. 43 E.
74
N
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 83)
East Spokane
St Ann School
Libby School
Liberty Park
Edison School
Sheridan School
Underhill Park
Alcott School
Franklin School
St Peters School
Lincoln Park
Lincoln Heights School
Pratt School
Edgecliff Park
Our Lady of Fatima School
Adams School
Ferris School
Hamblen School
KREM Radio Towers
KHQ Radio Tower
Glenrose
Prairie
QUARRY AND GRAVEL PIT
GRAVEL PIT
26
25
35
36
4
2
1
T. 25 N.
T. 24 N.
5000 Feet
Scale 1:20 000
1 Mile

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 75

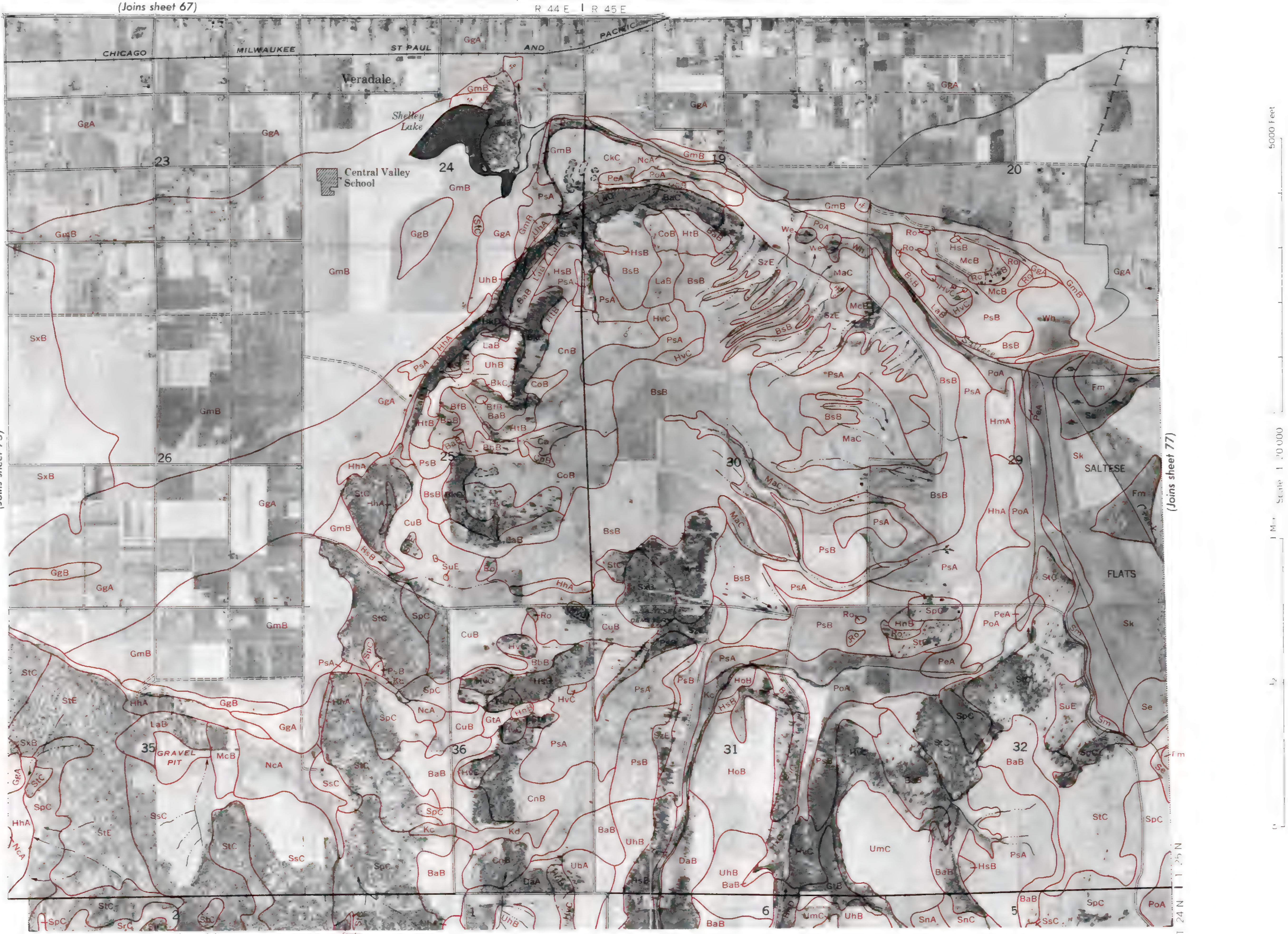


Scale 1:20 000

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

(Joins sheet 67)



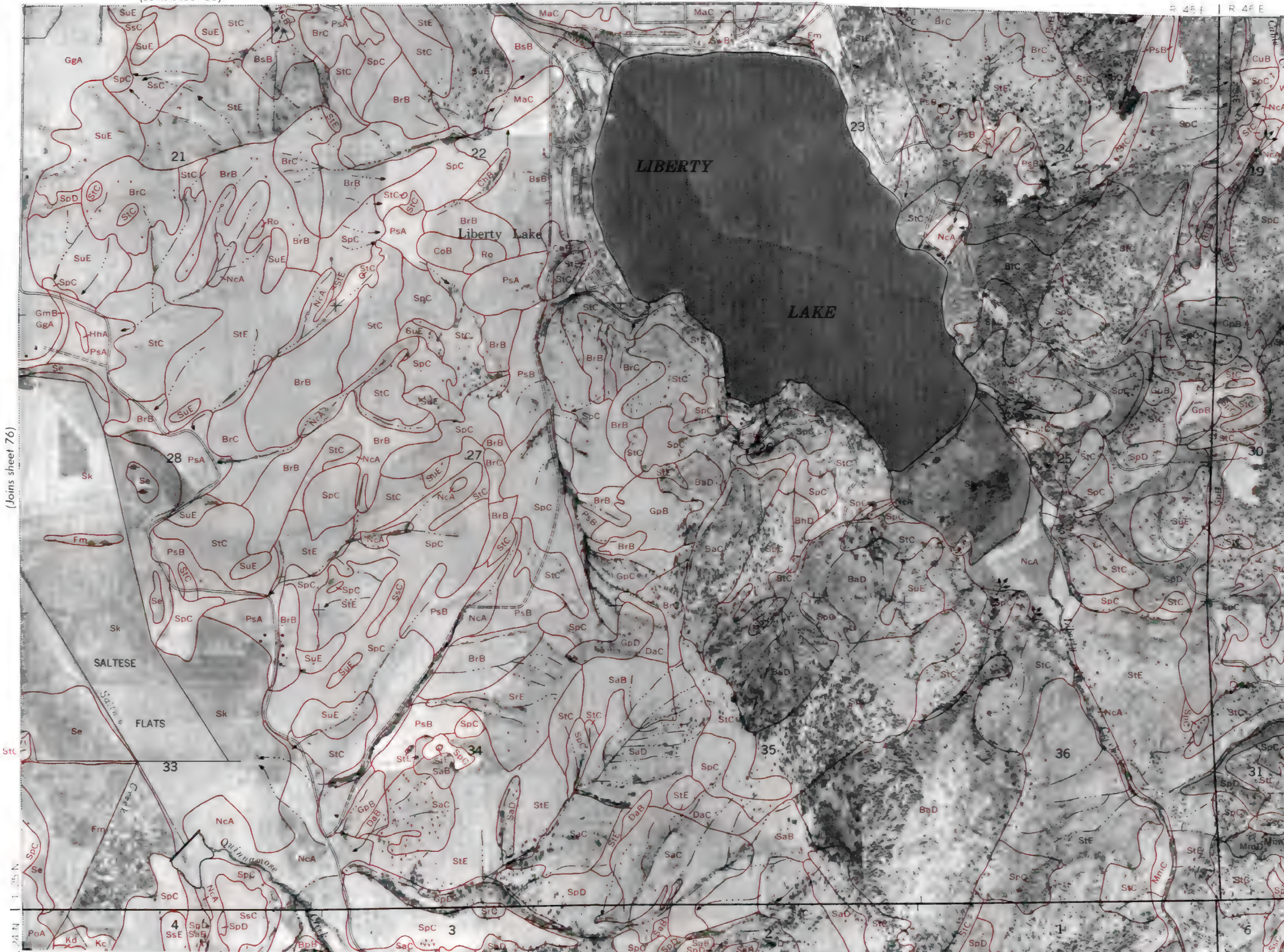
(Joins sheet 75)

(Joins sheet 77)

(Joins sheet 85)

(Joins sheet 68)

(Joins sheet 76)



(Joins sheet 86)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

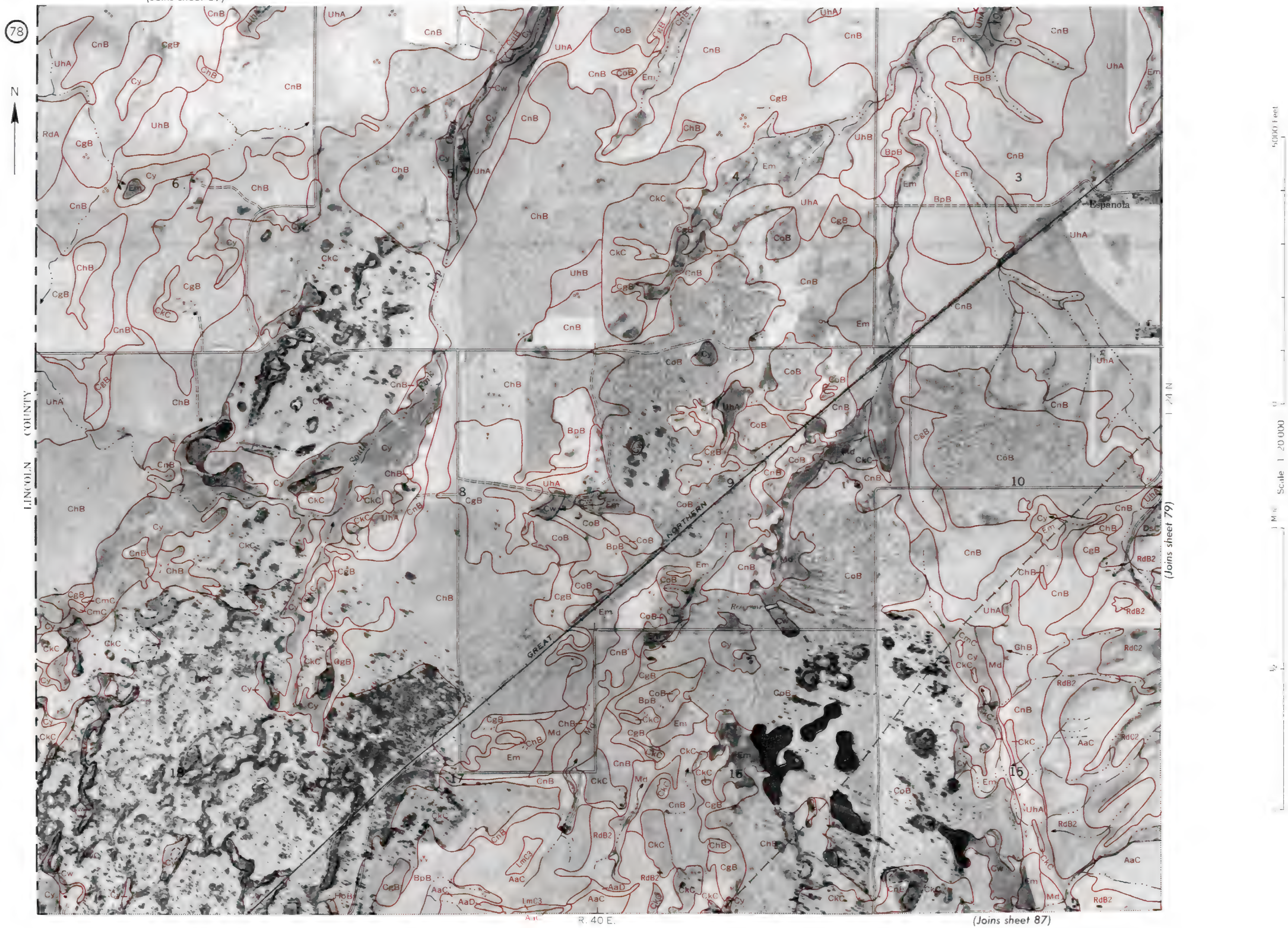
Range, township, and section corners shown on this map are indefinite.

Scale 1:20 000

1 Mile

5000 Feet

(Joins sheet 69)

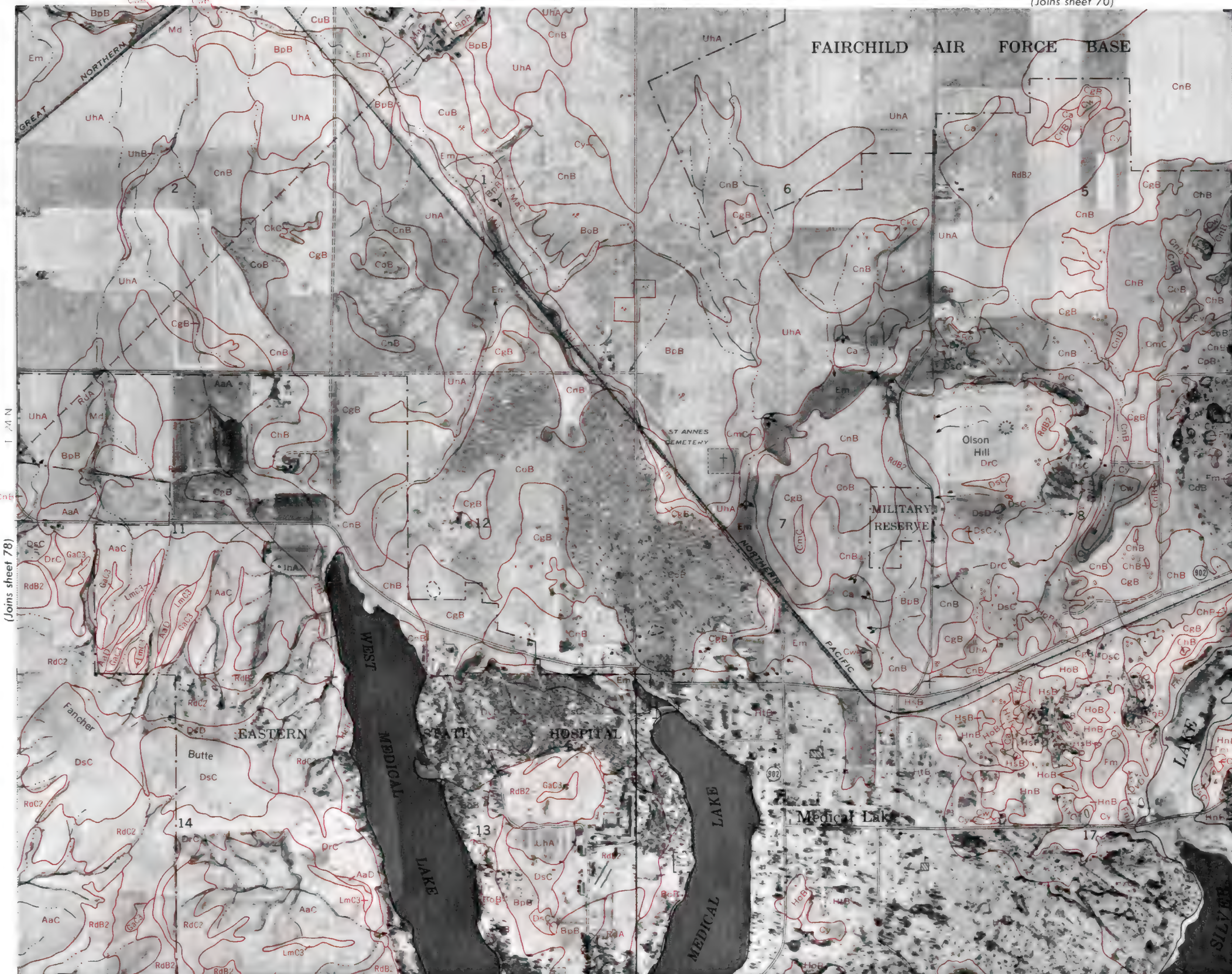


(Joins sheet 79)

(Joins sheet 87)

(Joins sheet 70)

79



(Joins sheet 78)

(Joins sheet 80)

(Joins sheet 88)

R 40 E | R 41 E

T 24 N

5000 Feet

0

Scale 1:20 000

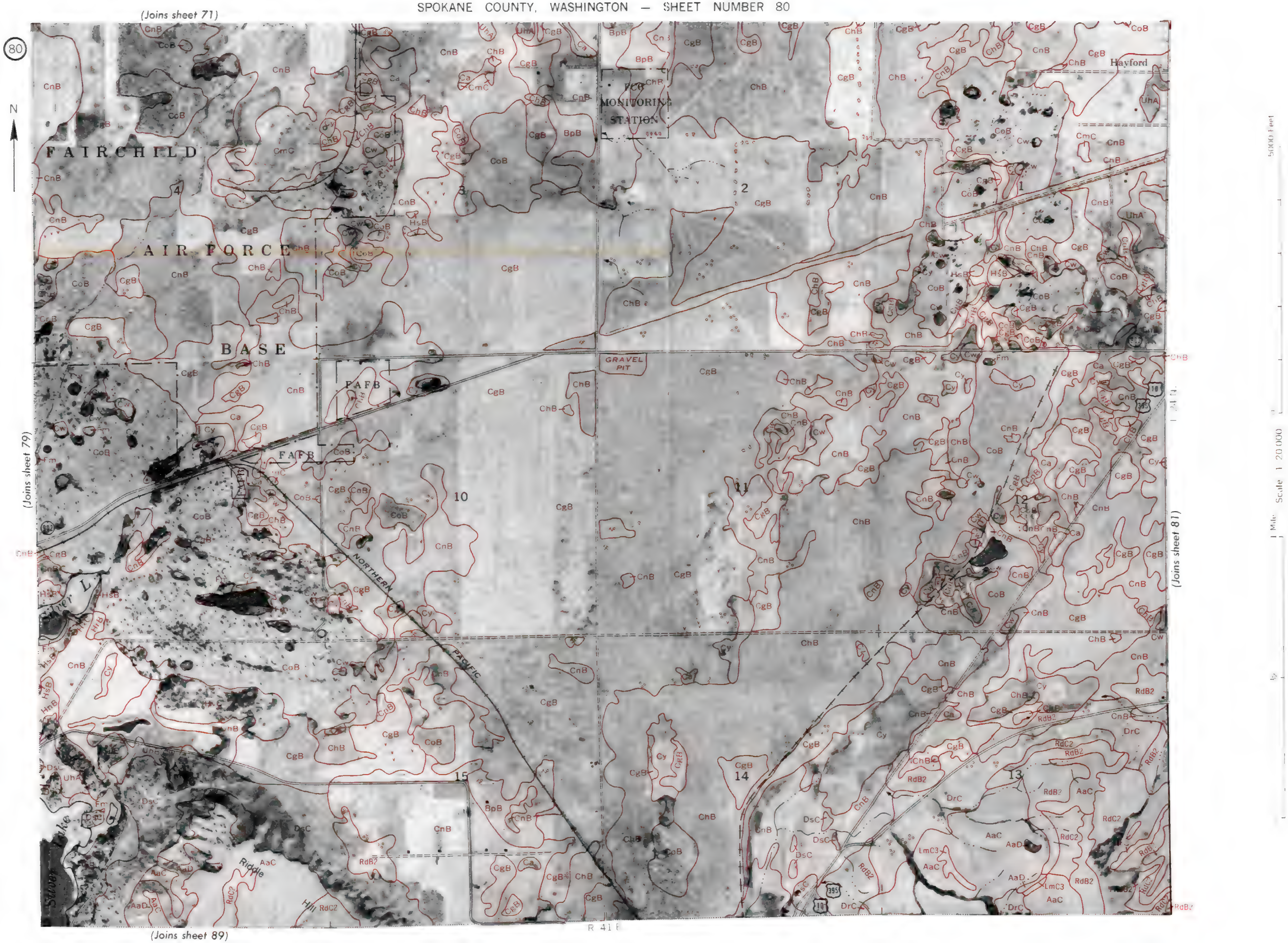
1 Mile

½

0

Range, township, and section corners shown on this map are indefinite

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station


(Joins sheet 71)
80
N
FAIRCHILD
AIR FORCE
BASE
FCC
MONITORING
STATION
Hayford
GRAVEL
PIT
FAFB
NORTHERN
PACIFIC
Riddle
Hill
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 89)
R 41 E
1 Mile
Scale 1:20 000
5000 Feet

This map is one of a set compiled in 196[illegible] as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite.

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 81

Scale 1:20 000

5000 Feet

1 Mile

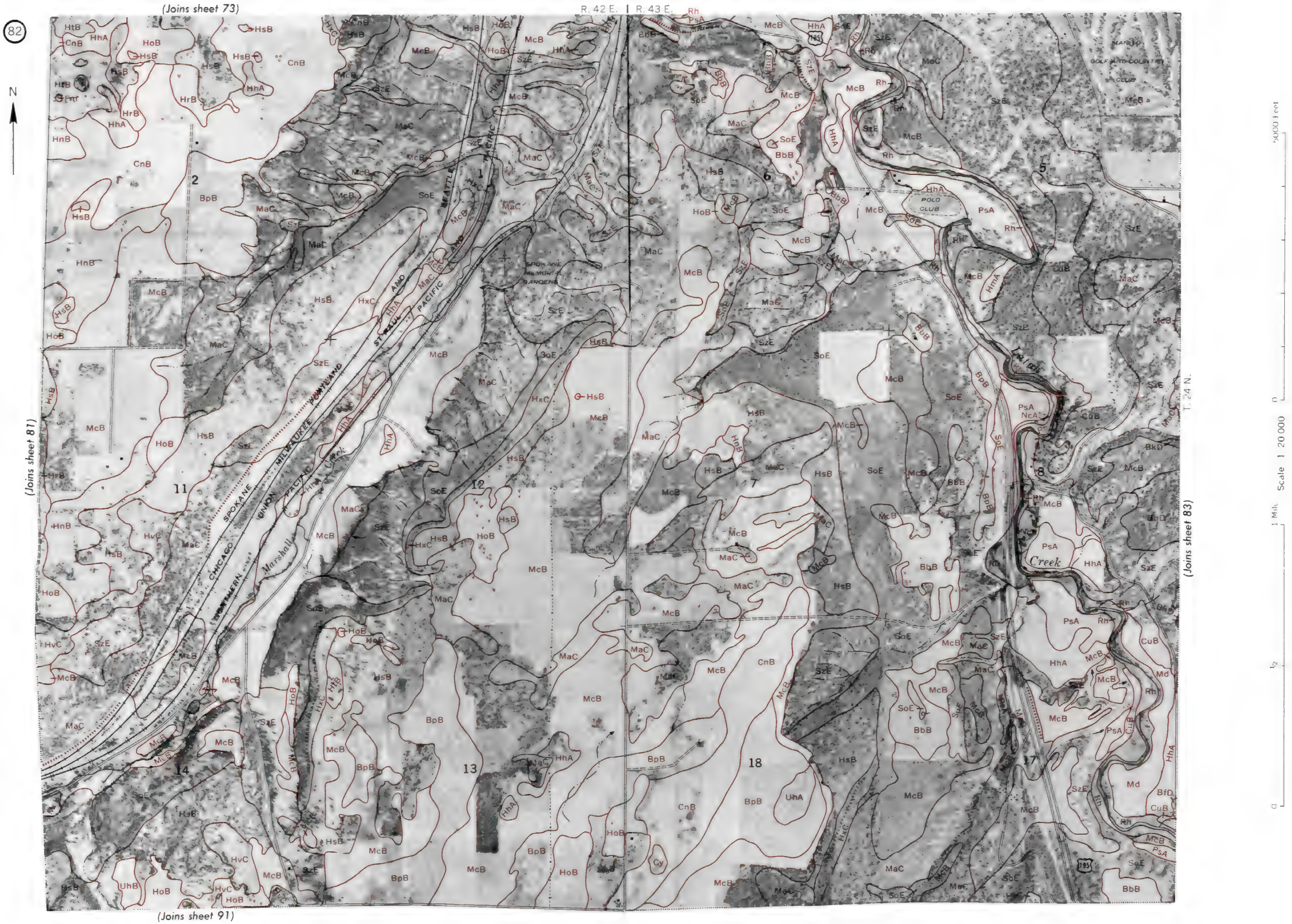
(81)

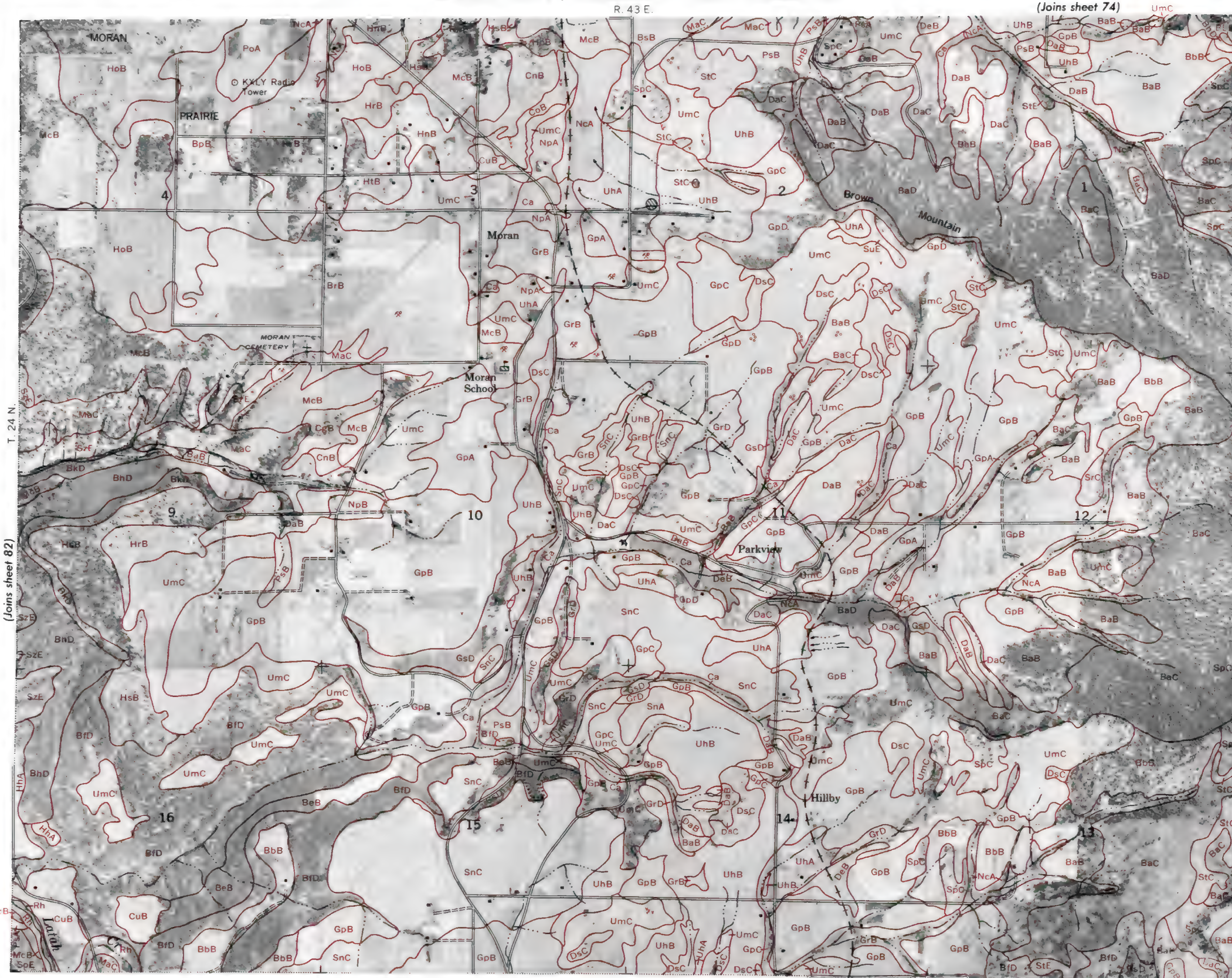
(Joins sheet 72)

(Joins sheet 80)

(Joins sheet 82)

(Joins sheet 90)


82
(Joins sheet 73)
R. 42 E. | R. 43 E.
N
(Joins sheet 81)
(Joins sheet 83)
(Joins sheet 91)
T. 24 N.
5000 Feet
0
1 Mile
Scale 1:20 000
½
0
SPOKANE MEMORIAL GARDENS
POLO CLUB
MANITO GOLF AND COUNTRY CLUB
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
SPOKANE PORTLAND AND SEATTLE
NORTHERN PACIFIC
UNION PACIFIC
Marshall Creek
Latah Creek

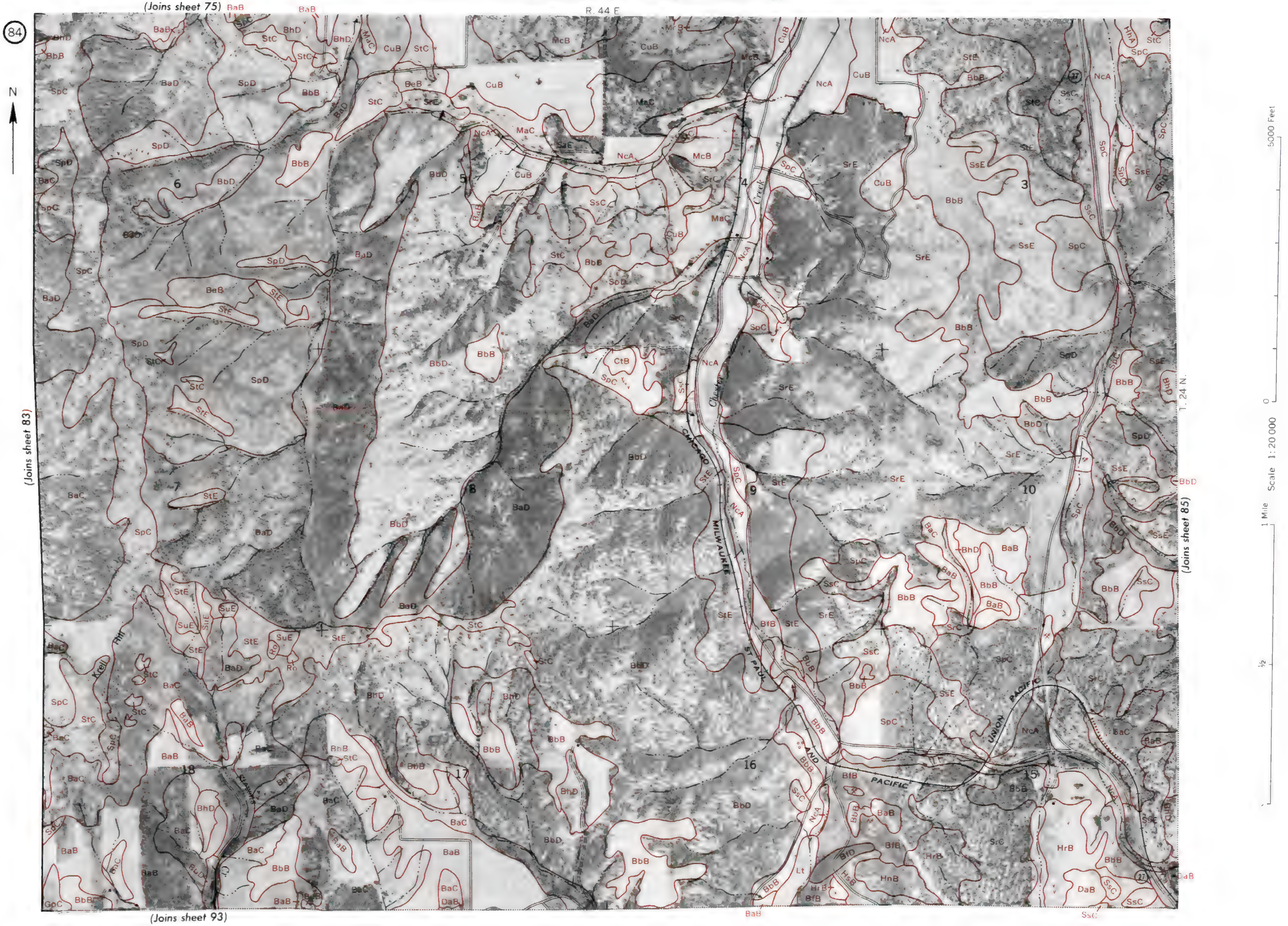


5000 Feet
0
20 000
Scale
1 Mile
½
0

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 84



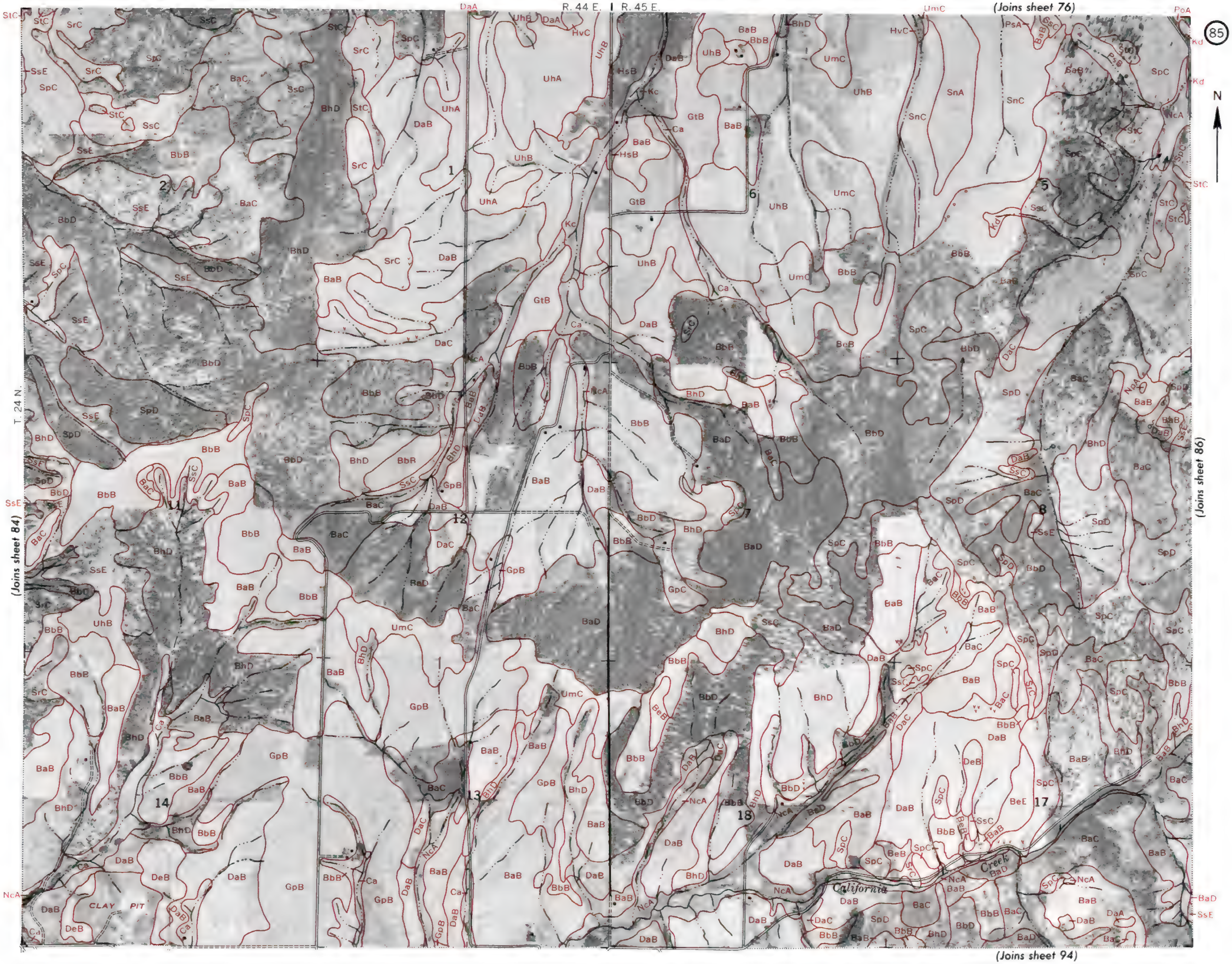
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite

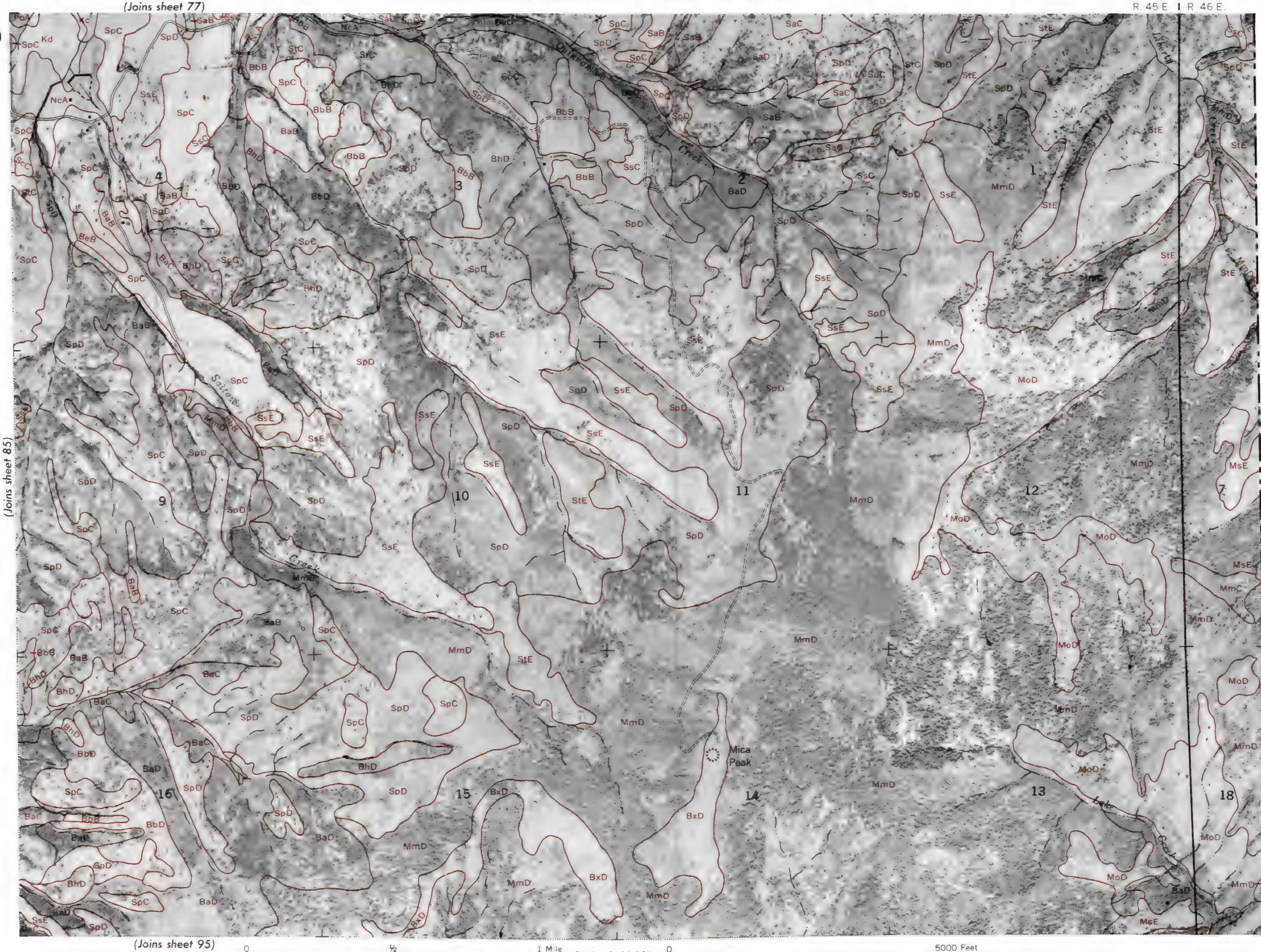
Scale 1:20 000

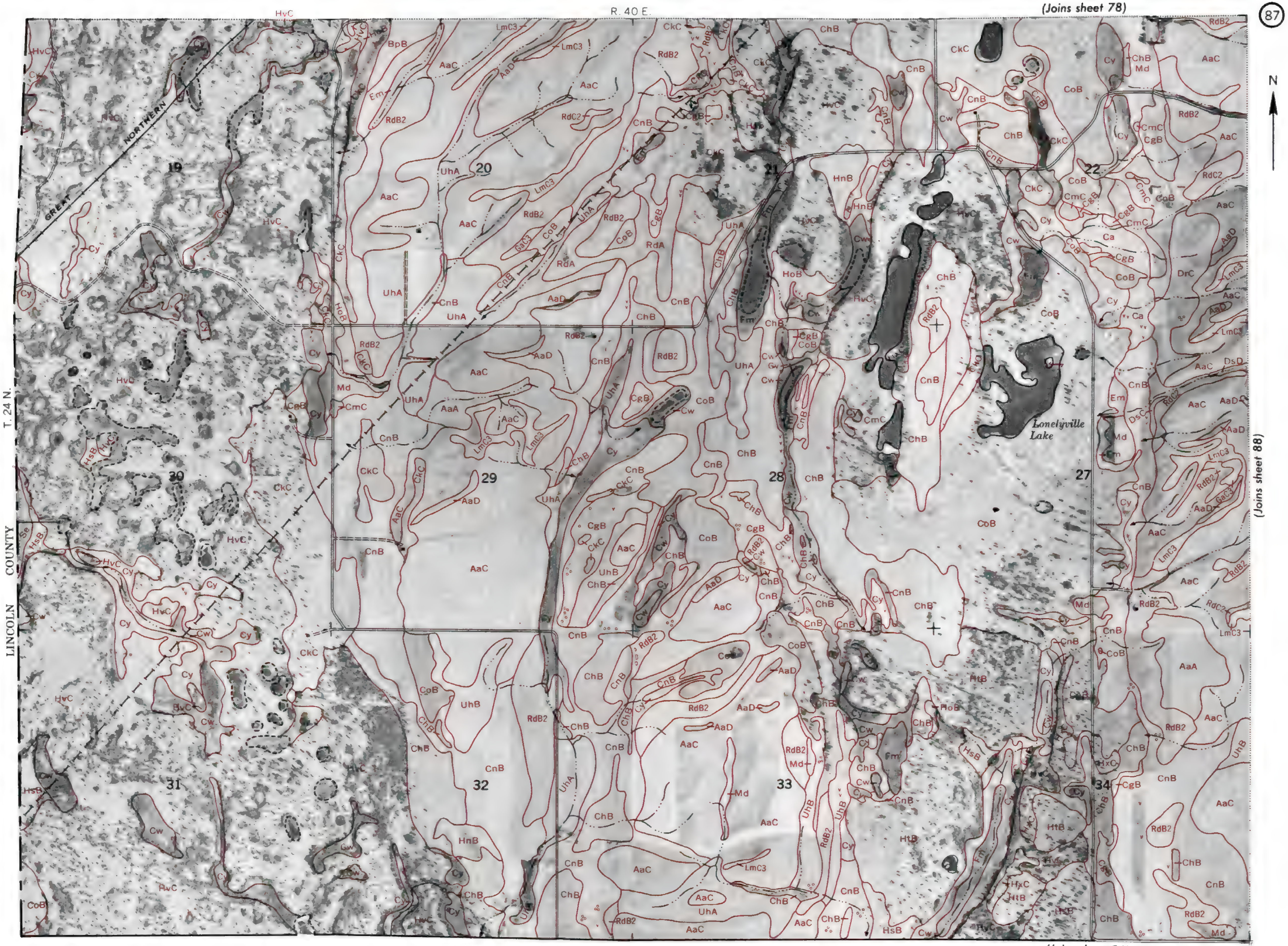
5000 Feet 0

1 Mile ½ 0



SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 86

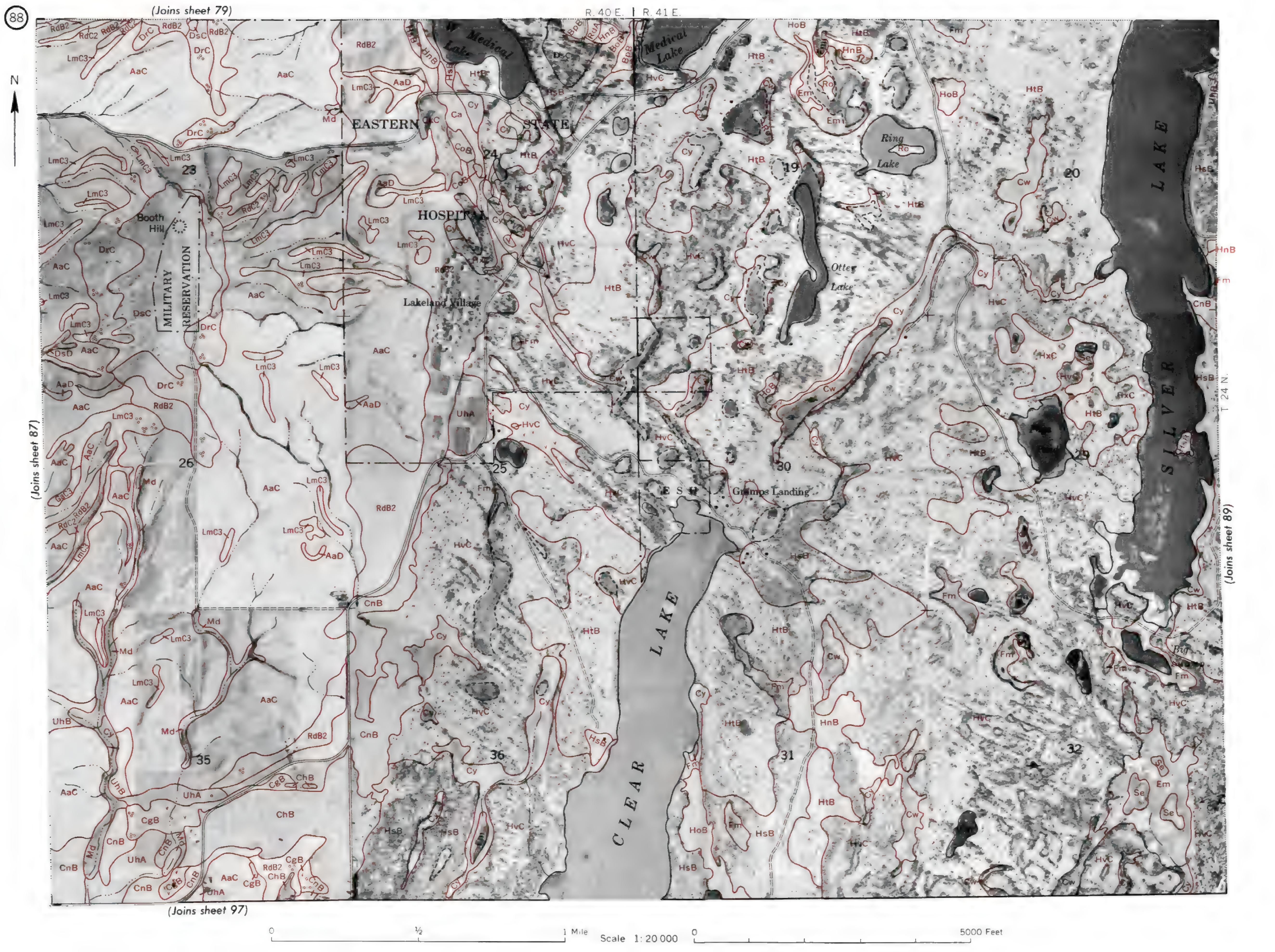




0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

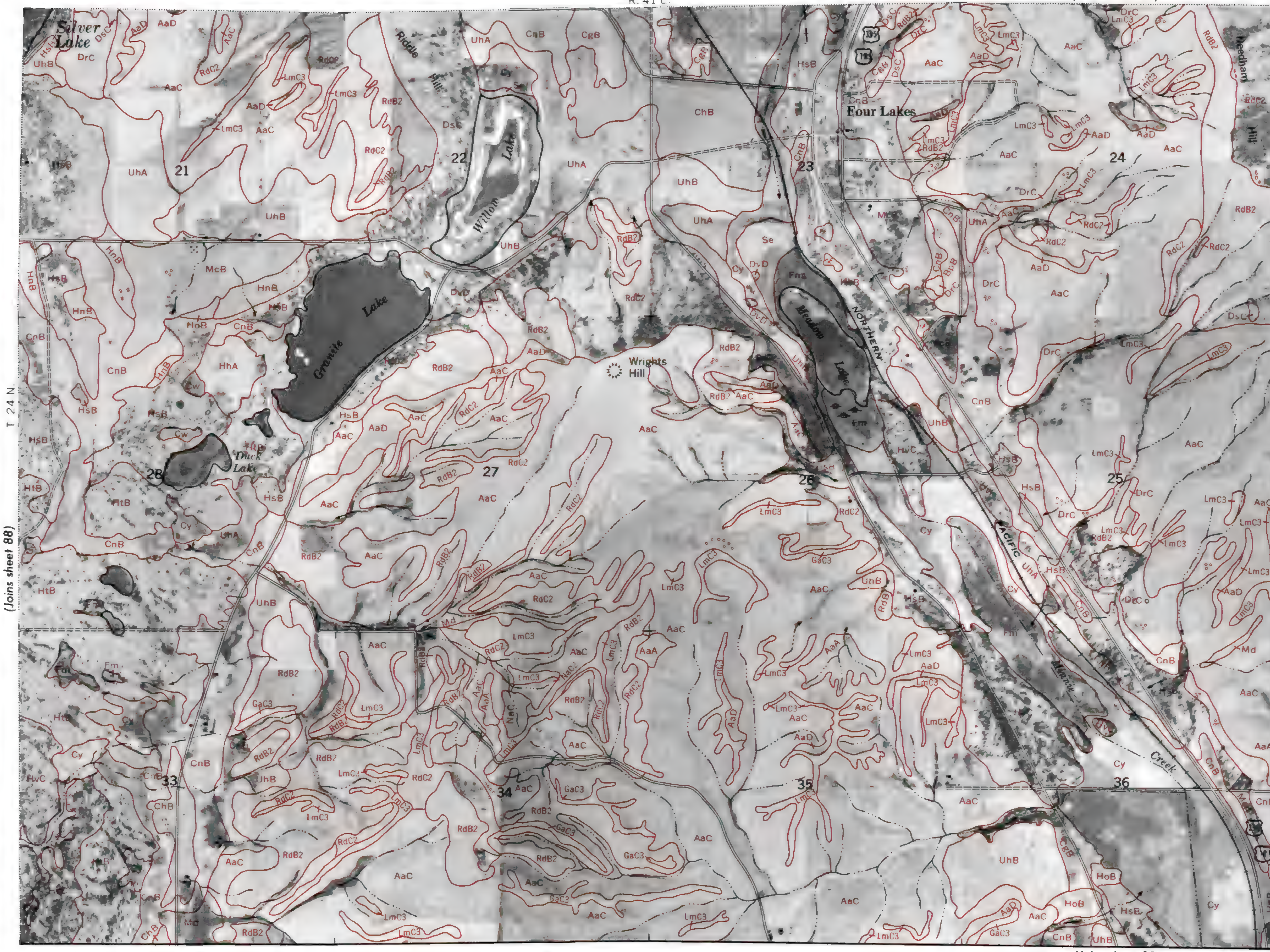
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite


88
(Joins sheet 79)
R. 40 E. | R. 41 E.
(Joins sheet 87)
(Joins sheet 89)
T. 24 N.
(Joins sheet 97)
Medical Lake
EASTERN STATE HOSPITAL
Lakeland Village
Booth Hill
MILITARY RESERVATION
Ring Lake
Otter Lake
SILVER LAKE
CLEAR LAKE
Grimms Landing
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

(Joins sheet 80)

89



(Joins sheet 88)

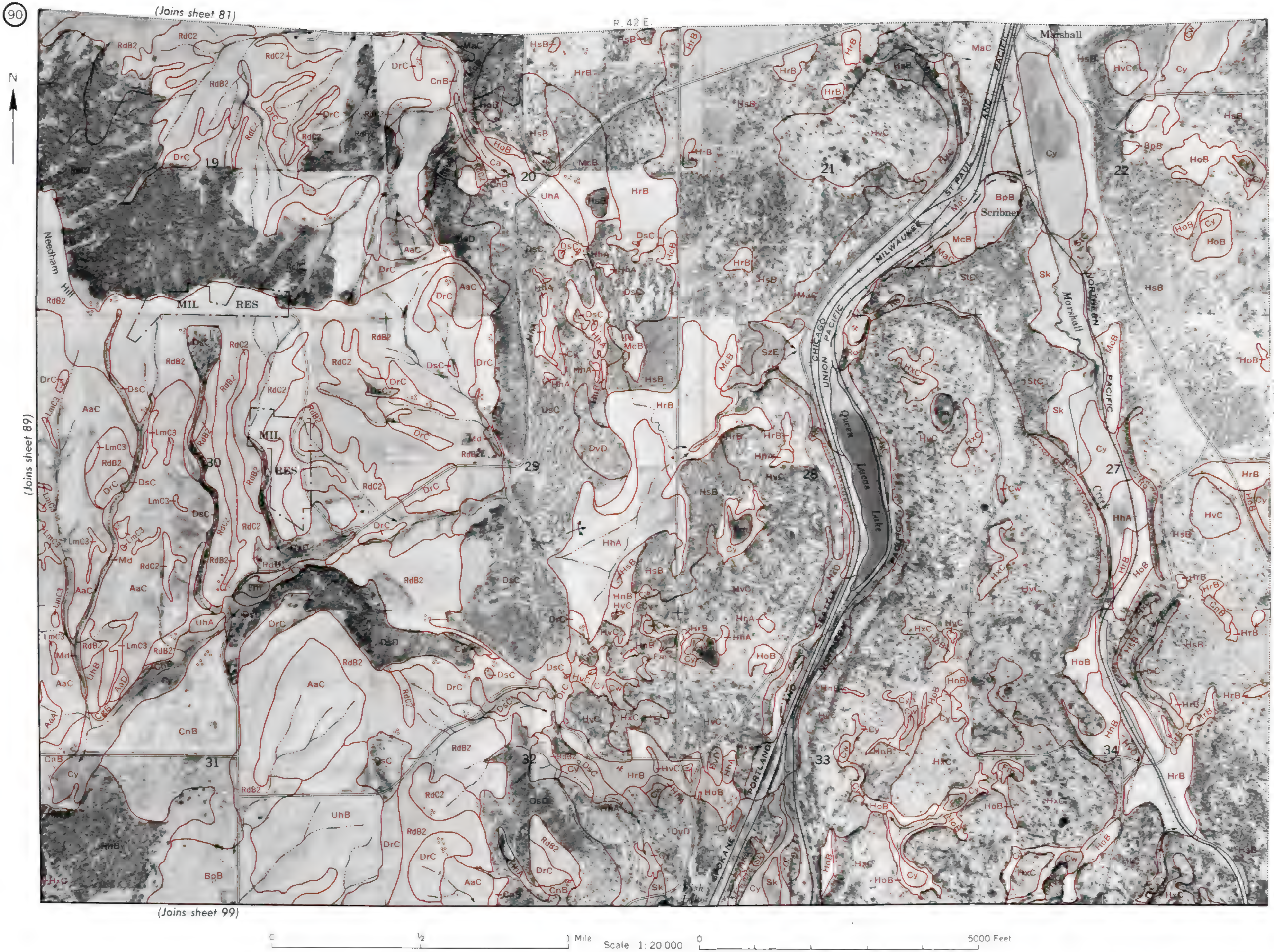
(Joins sheet 90)

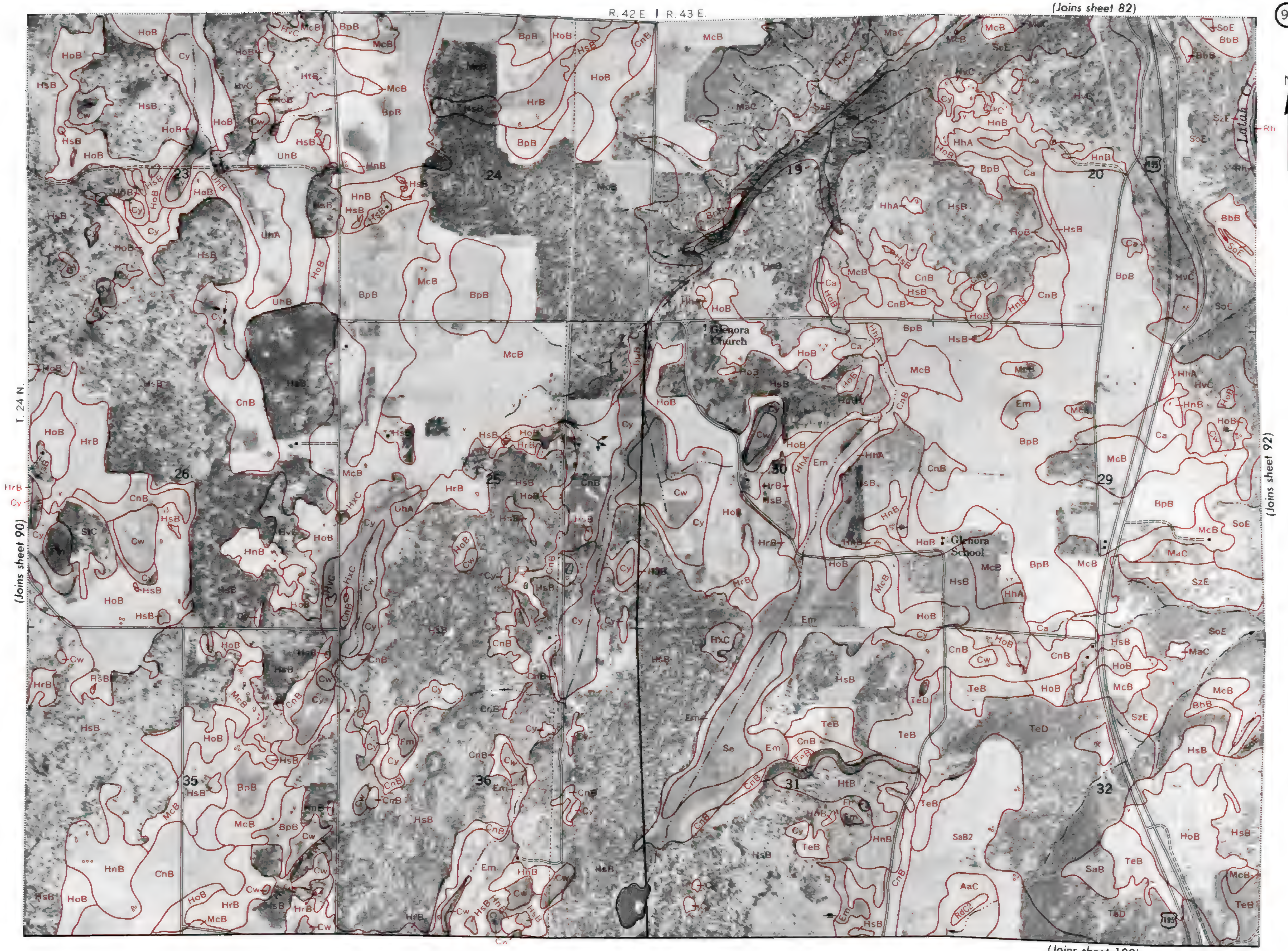
(Joins sheet 98)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

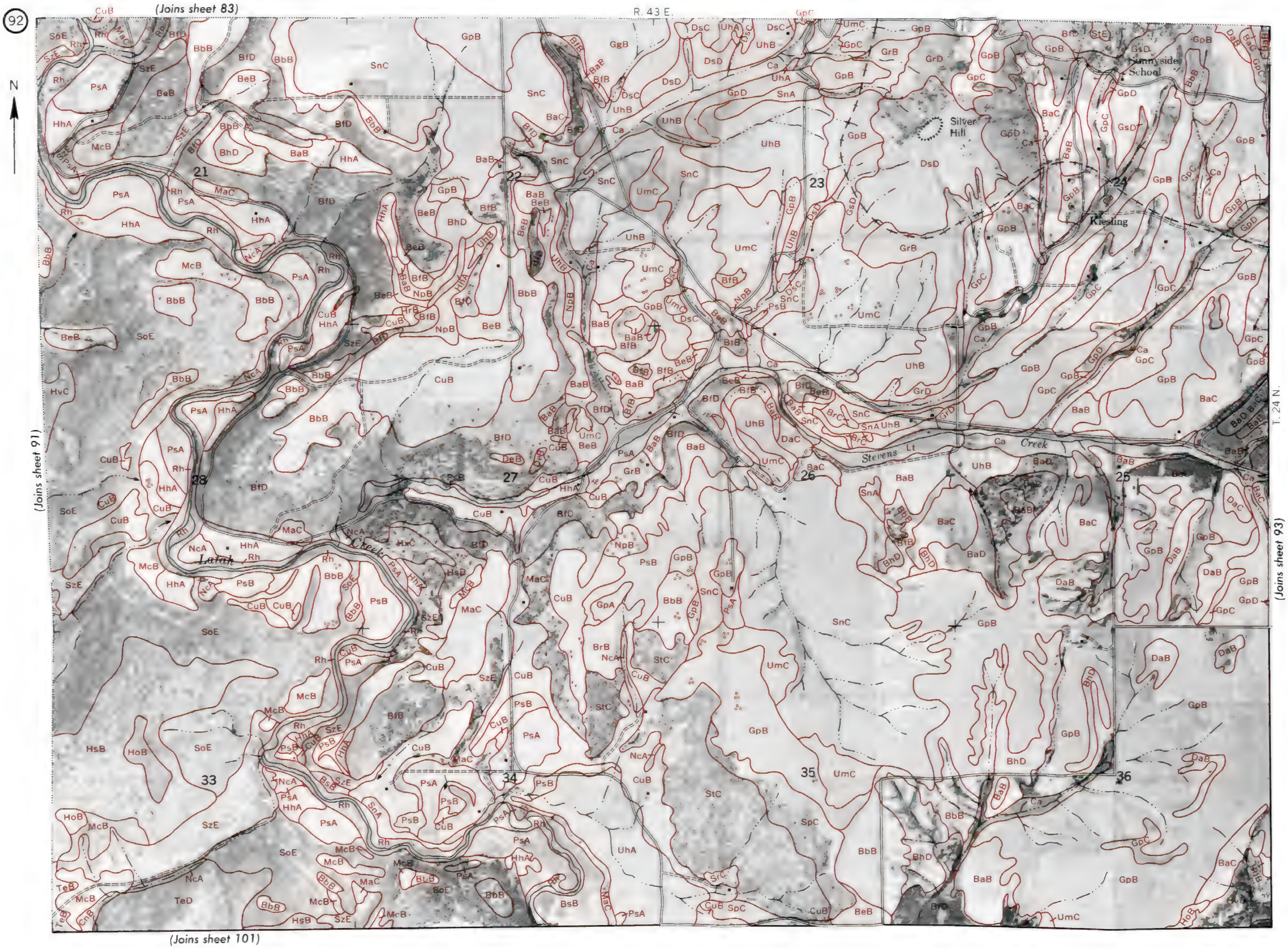

90
(Joins sheet 81)
R. 42 E.
N
Marshall
Needham Hill
MIL RES
MIL RES
Scribner
Queen Lucas Lake
Marshall Creek
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
UNION PACIFIC
NORTHERN PACIFIC
SPOKANE PORTLAND AND SEATTLE
(Joins sheet 89)
(Joins sheet 91)
(Joins sheet 99)
19
20
21
22
27
28
29
30
31
32
33
34
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

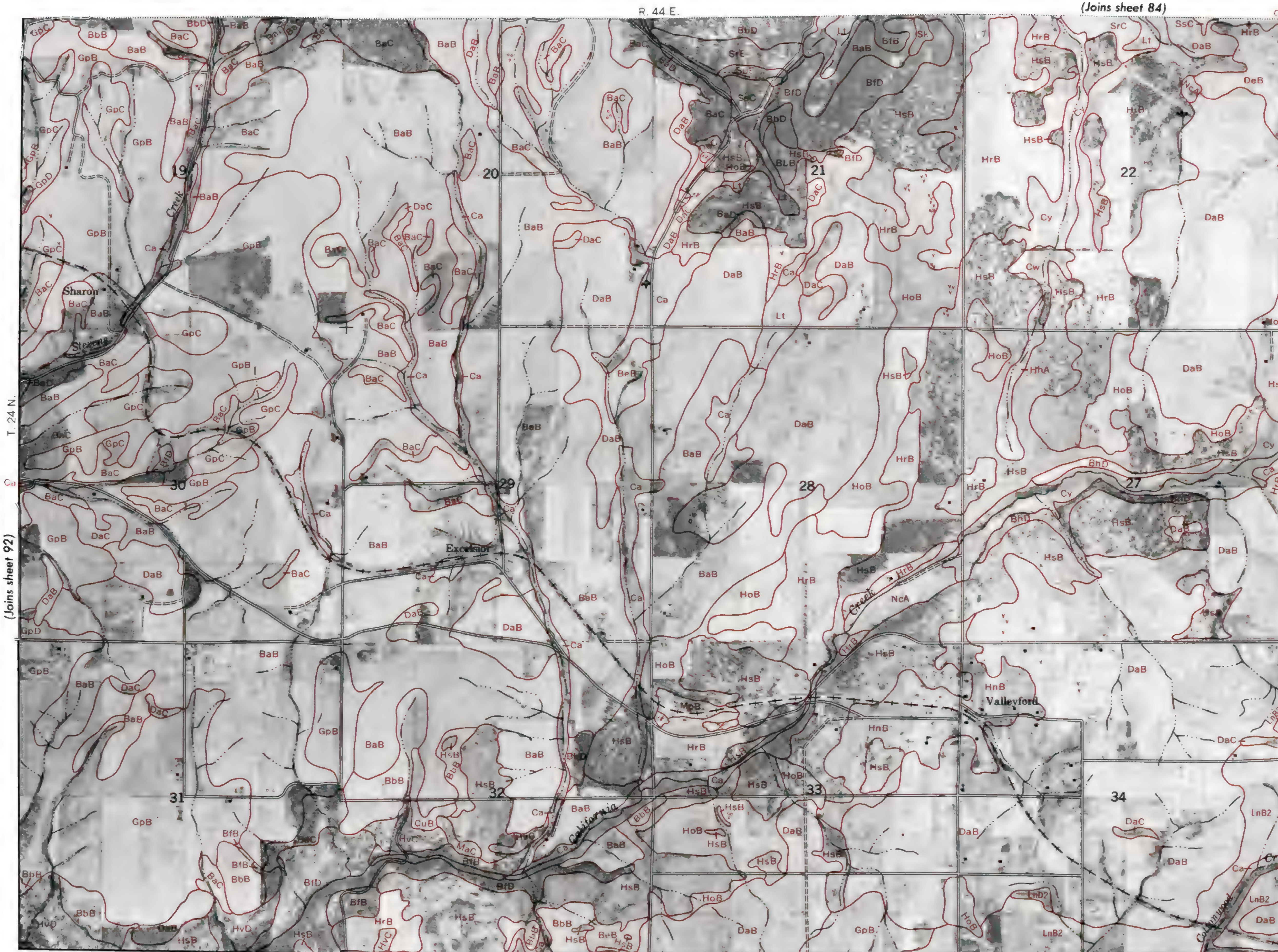
Range, township, and section corners shown on this map are indefinite.



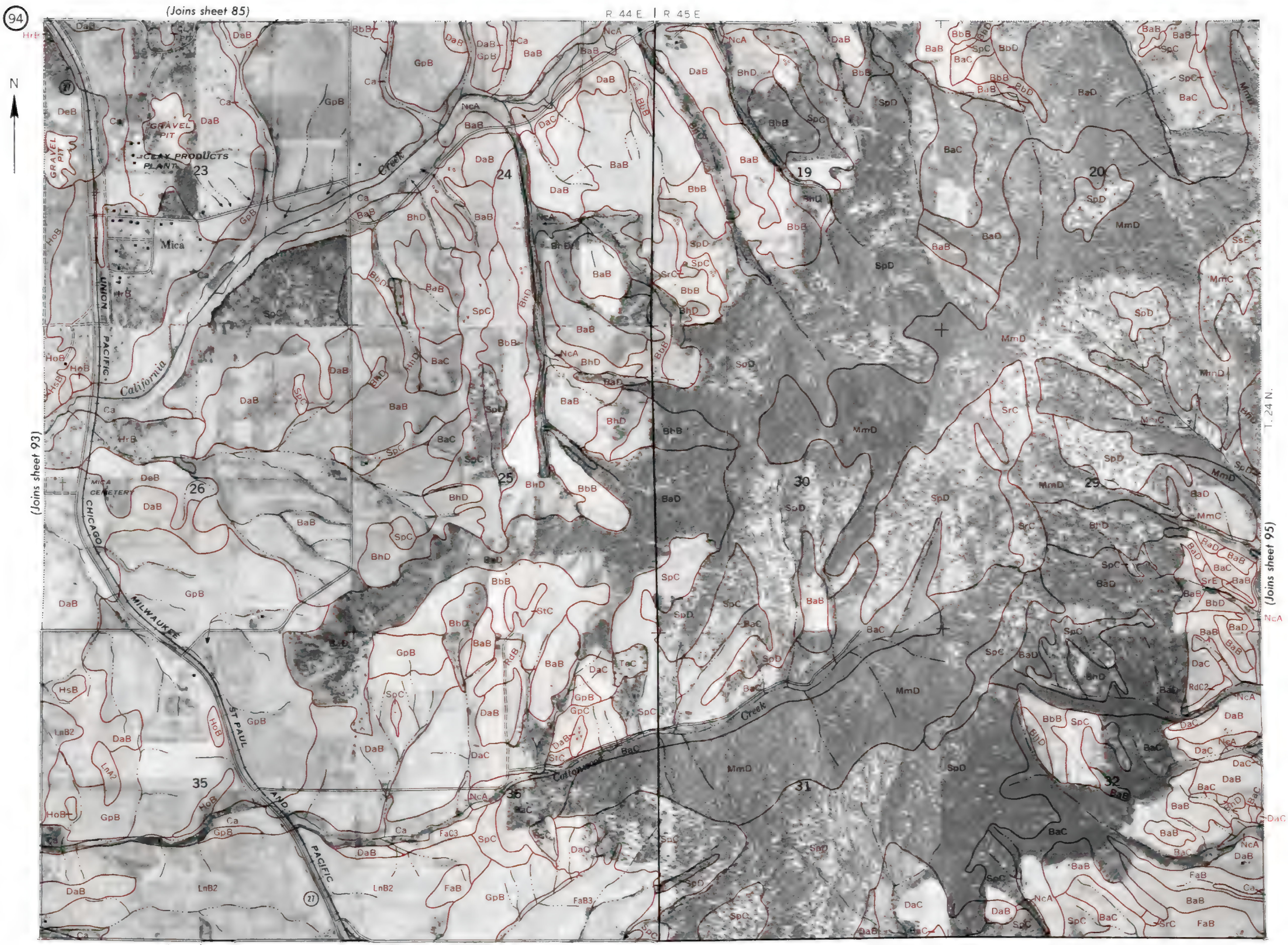
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station

Range, township, and section corners shown on this map are indefinite

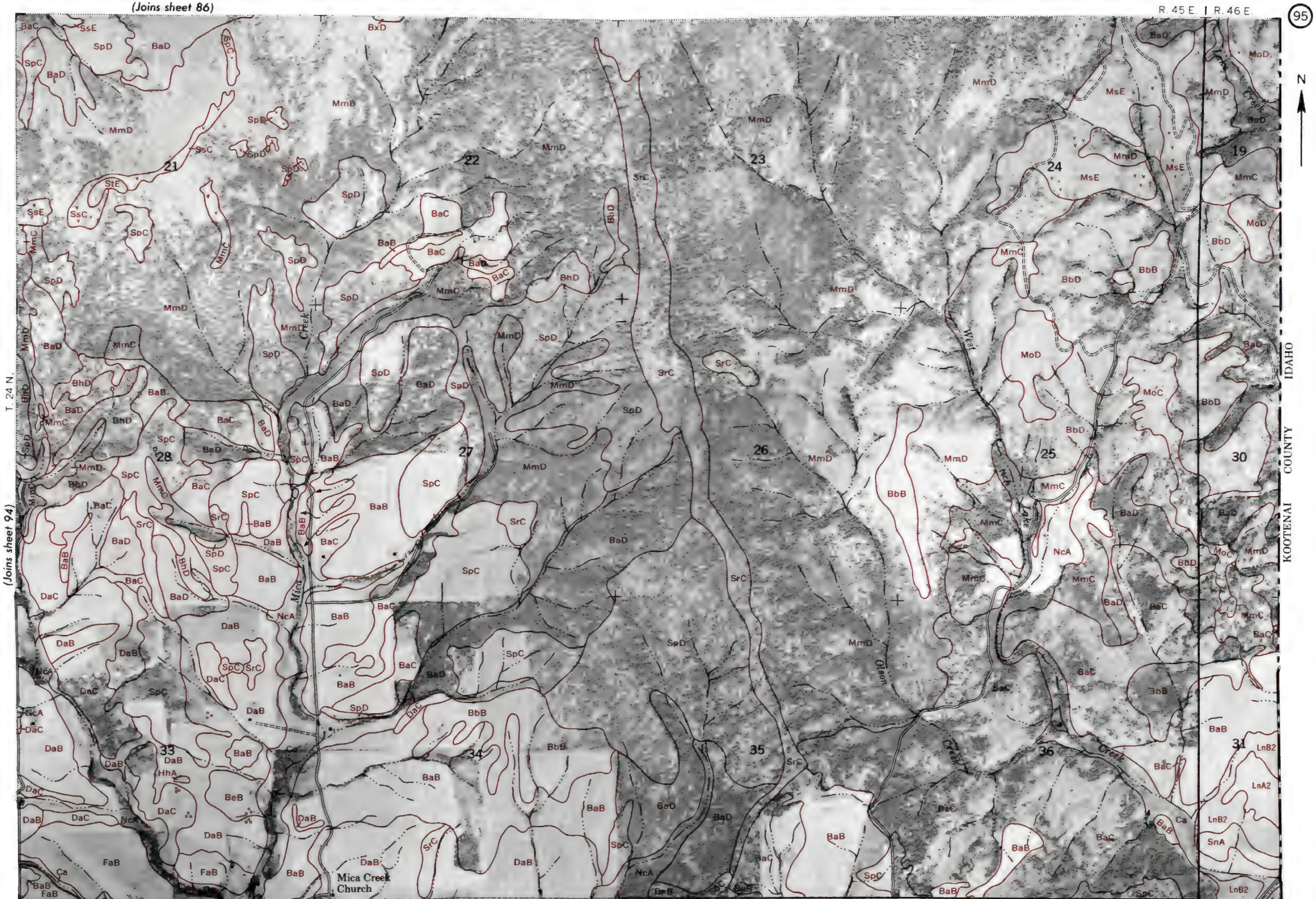


0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 86)



(Joins sheet 94)

(Joins sheet 104)

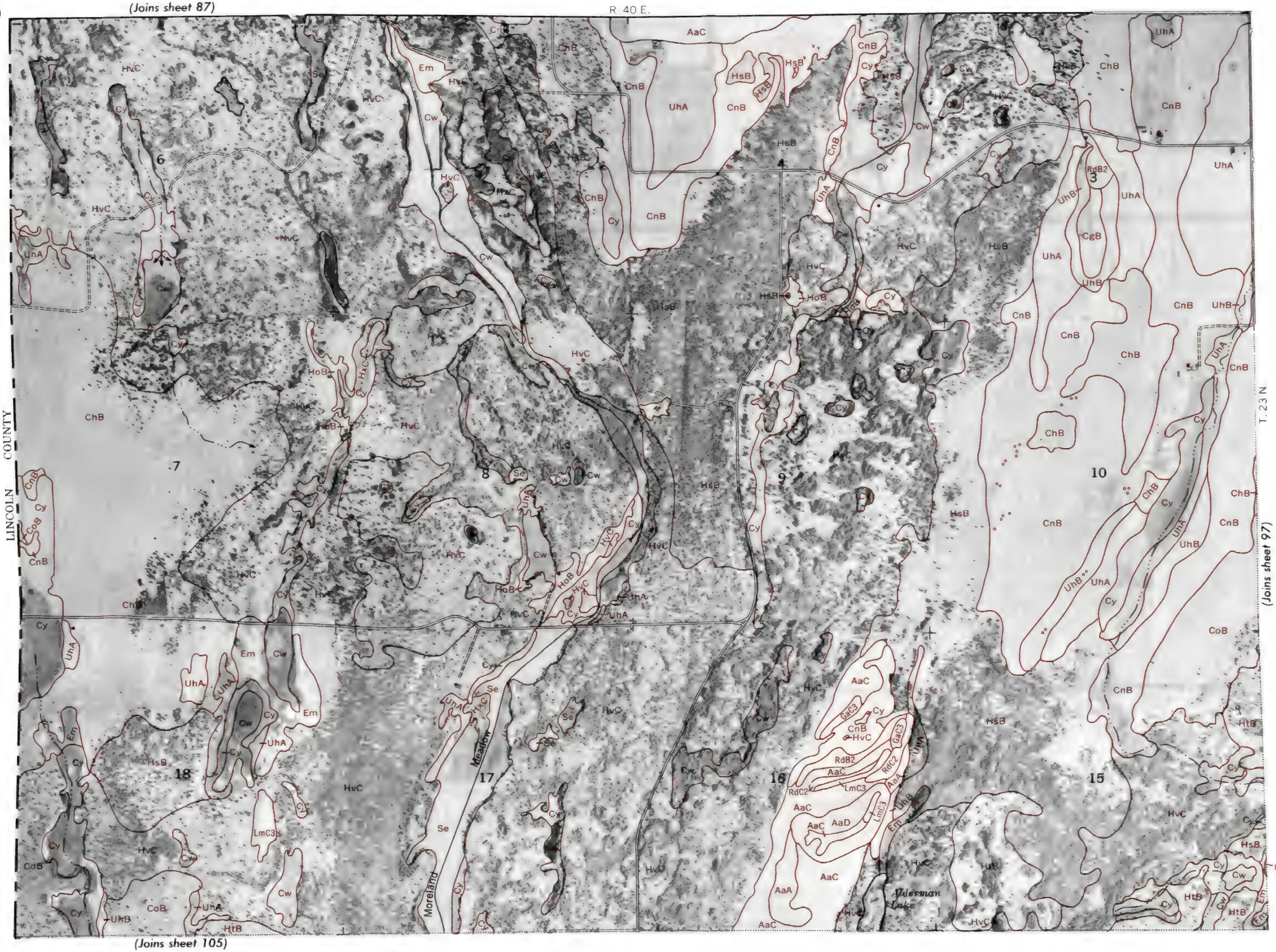
FaB3

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

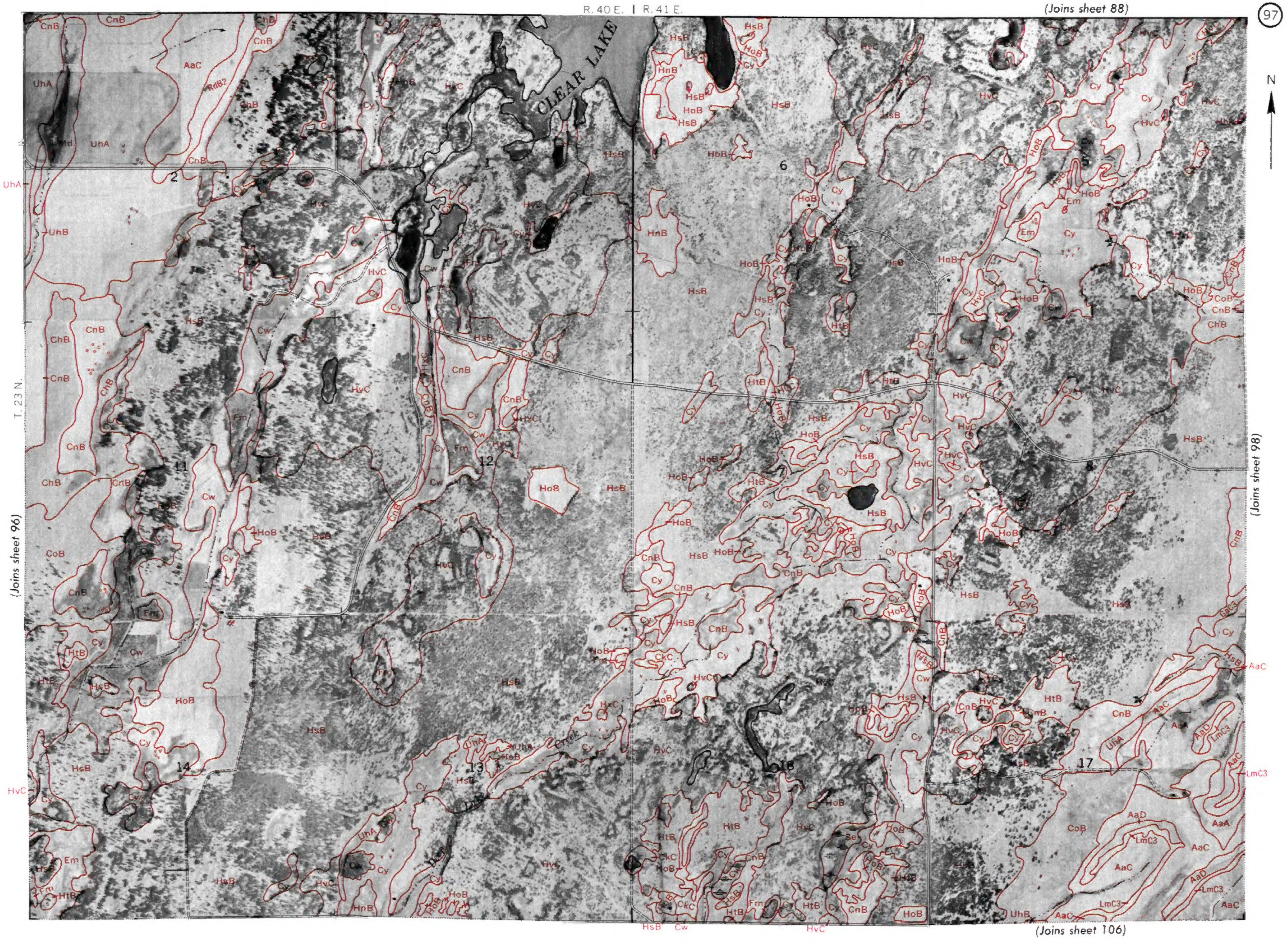
96



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

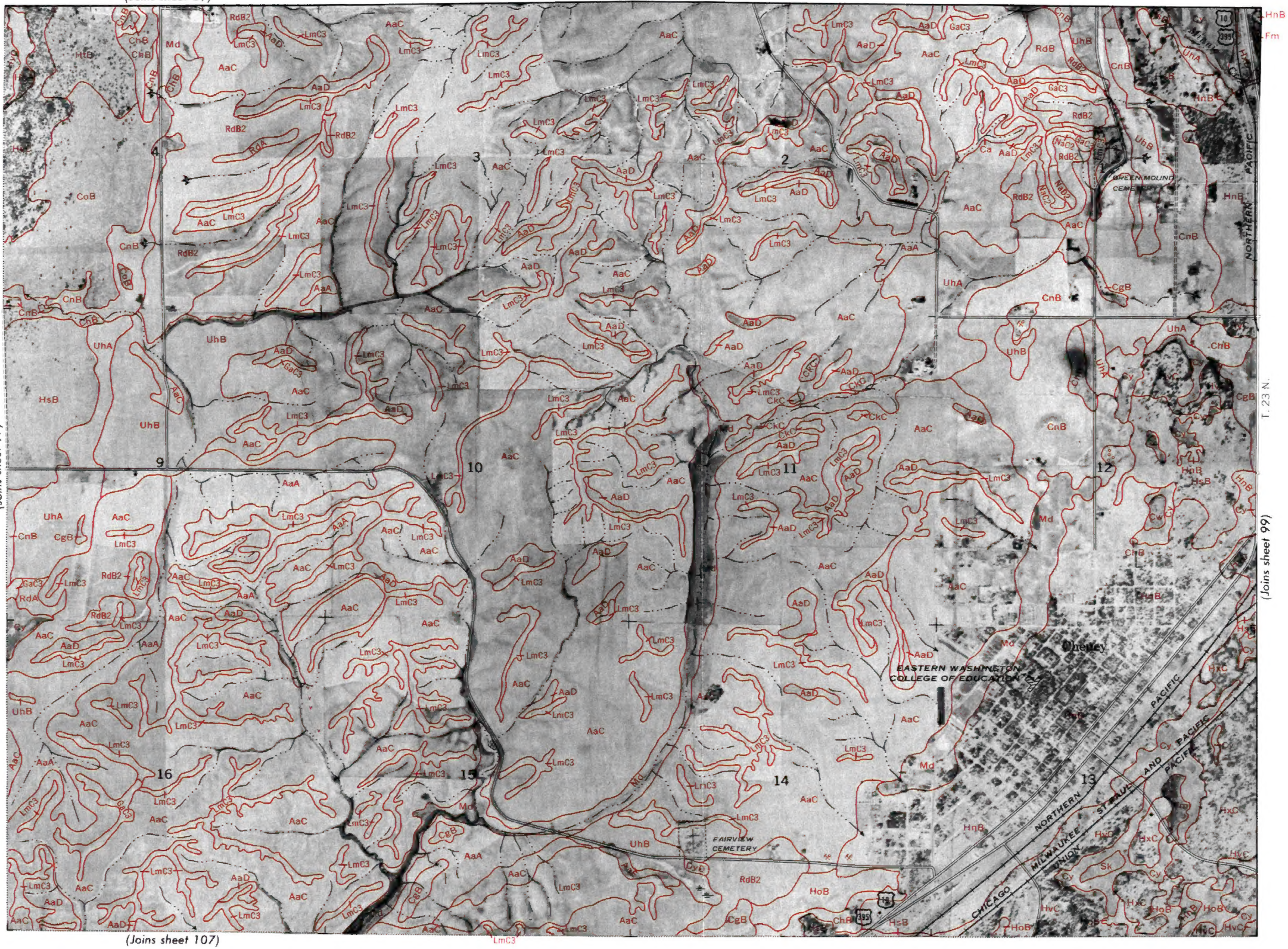


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

98

(Joins sheet 89)

R. 41 E.



(Joins sheet 97)

T. 23 N.

(Joins sheet 99)

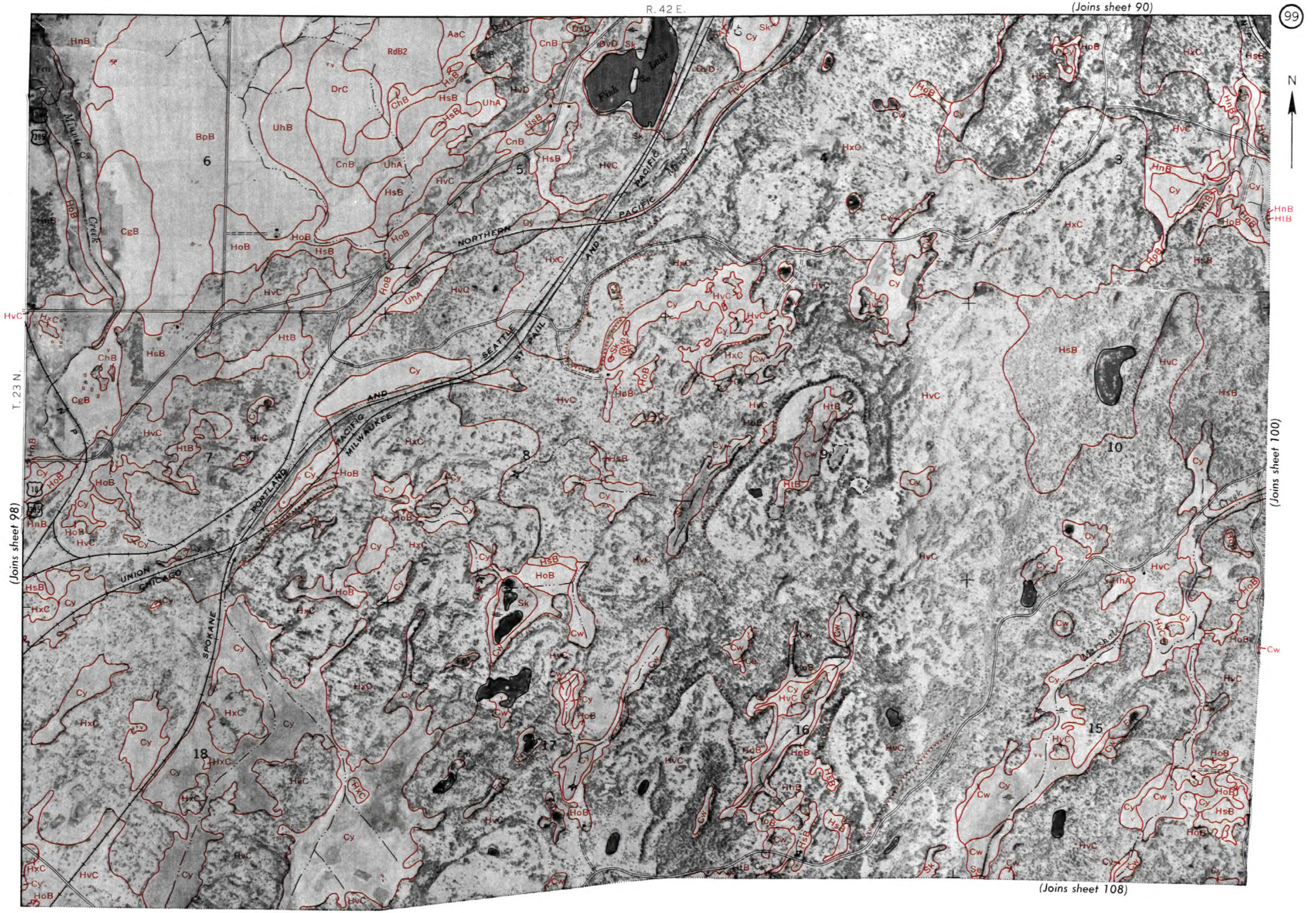
(Joins sheet 107)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

SPOKANE COUNTY, WASHINGTON — SHEET NUMBER 99

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Washington Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

SPOKANE COUNTY, WASHINGTON
CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings

- School
- Church
- Station

Mines and Quarries

Pits, gravel or other

Power line

Pipe line

Cemetery

Dams

Levee

Tanks

Windmill

Forest fire or lookout station

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant

DRAINAGE

Streams

- Perennial
- Intermittent, unclass.

Canals and ditches (CANAL, DITCH)

Lakes and ponds

- Perennial
- Intermittent

Wells (flowing)

Springs

Marsh

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments

- Bedrock
- Other

Prominent peaks

Depressions (Large, Small)

- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Kitchen midden